

Participation, Commercialisation and Actor Networks: The Political Economy of Cereal Seed Production Systems in Ghana

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The Political Economy of Cereal Seed Systems in Africa

Preface

This *FAC Working Paper* is part of the first phase of a collaborative research project of the Science, Technology and Innovation (STI) Theme of the Future Agricultures Consortium (FAC). It was funded through a grant from the UK Department for International Development (DFID). The project explored the political economy of cereal seed systems across five distinct country contexts – Ethiopia, Kenya, Malawi, Ghana and Zimbabwe – during 2009-10. The evolution of seed research and development programmes and processes has varied greatly across these countries. In each case, a unique set of public and private actors and interests has been involved in defining priorities in seed policy and implementing projects, each seeking to influence those agendas to their advantage. Moreover, each country has a different reliance on ‘modern’ hybrid (or sometimes biotech) varieties and associated R&D and supply systems and an independent informal sector, involving networks of farmer experimenters and seed bulkers and suppliers, with varying degrees of capacity.

As calls for a ‘Uniquely African Green Revolution’ gain momentum, the focus on seeds and seed systems is rising up the agricultural policy agenda. Much of the debate stresses the technological or market dimensions, with substantial investments being made in seed improvement and the development of both public and private sector delivery systems. But there is currently much less emphasis on the wider policy dimensions – and particularly the political economy of policymaking in these diverse agricultural contexts.

Experience tells us it is these factors that often make or break even the best designed and most well intentioned intervention. And since investment in seed improvement and supply was last emphasised as a major priority in agriculture (in the 1970s and 80s), contexts have changed dramatically. The collapse of national public sector breeding systems has been dramatic, and this has only partially been compensated for by the selective entry of the private sector. Large multinational seed and agricultural supply companies are increasingly dominating the global scene, and there are many claims made about the promises of new technologies (notably transgenics) transforming the seed sector through a technological revolution. While informal breeding and seed supply systems continue to exist, and indeed have been extensively supported through NGOs and other civil society groups, they are often under pressure, as drought, corruption and conflict take their toll and economic transformation and livelihood change continues apace, or they are ignored or excluded from policy circles.

The focus on *cereal* seed systems allowed this project to concentrate on a similar set of crops across the five study countries with a key influence on food security at household and national levels. Given the political reverberations of the ‘food crisis’ of 2007-08, this enabled

timely analysis of the implications of the policy processes shaping the breeding, production, marketing and distribution of cereal seeds. As this *FAC Working Paper* shows, whether grown for local subsistence or traded commercially, the significance of cereal crops to national politics (and therefore arguments about food security and sovereignty), commercial interests and local livelihoods is profound.

To gain clear insights into the policy actors, networks, interests and narratives at play, this project sought to test the hypothesis that contrasting politics and different configurations of interests will affect the way cereal seed systems operate and shape how a ‘New Green Revolution’ will ultimately play out. As such, the five country studies analysed their respective national seed policy processes by asking:

- How do seed policies get created, and by whom?
- How do ideas about what makes a ‘good seed policy’ change over time?
- How are boundaries drawn around seed problems and policy ‘storylines’ elaborated?
- Whose voices are taken into account in the seed policy process? And whose are excluded?
- What spaces exist for new ideas, actors and networks? How can these be opened up?

The underlying implication in all these cases is that politics matter and that by engaging critically with seed policy processes, we can begin to define and then deliberate among different framings and interests to shift the focus of the debate beyond the usual technical/market fix.

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Acronyms

ACDEP	Association of Church Development Projects
ADB	Agricultural Development Bank
ADVANCE	Agricultural Development and Value Chain Enhancement
AGRA	Alliance for a Green Revolution in Africa
CAADP	Comprehensive Africa Agriculture Development Programme
CARD	Coalition on African Rice Development
CIDA	Canadian International Development Aid
CIMMYT	International Maize and Wheat Improvement Centre Maize
CPP	Convention People's Party
CRI	Crop Research Institute
CTA	Centre for Agriculture and Rural Cooperation
DGIS	Ministry of Foreign Affairs of The Netherlands
ETC	Erosion, Technology, Concentration Group
FAO	Food and Agriculture Organization
FPR	farmer participatory research
GDC	Gonja Development Company
GGDP	Ghana Grains and Development Project
GGLB	Ghana Grains and Legumes Board
GRAIN	Genetic Resources Action International
GSC	Ghana Seed Company
GSIS	Ghana Seed Inspection Division
GTZ	German Technical Cooperation
GVRC	Ghana Varietal Release Committee
ICRISAT	International Crop Research institute for the Semi-Arid Tropics
IFDC	International Fertilizer Development Center
IFIs	International financial institutions
IITA	International Institute for Tropical Agriculture
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
MCC	Millennium Challenge Corporation
MiDA	Millennium Development Authority
MOFA	Ministry of Food and Agriculture
NAES	Nyankpala Agricultural Experimental Station
NGO	Non-governmental organisation
NLC	National Liberation Council
PP	Progress Party
PTPs	Production test plots
QPM	Quality Protein Maize
RAFI	Rural Advancement Foundation International
RELC	Research and Extension Linkage Committees
SARI	Savanna Agricultural Research Institute
SFMC	Savanna Farmers Marketing Company Ltd
SG 2000	Sasakawa Global 2000
SSC	Savanna Seed Company
TRIPs	Trade-Related Aspects of Intellectual Property Rights
UDS	University of Development Studies
UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WAPCB	West African Produce Control Board
WARDA	Africa Rice Centre
WASA	West African Seed Association

Abstract

This paper examines the changing framework of cereal seed policy in Ghana from a state-led public sector service in the 1960s to a commercial sector activity in the 2000s, and the implications of these changes. The work argues that attempts to privatise seeds during the 1980s and 1990s under structural adjustment were not very successful, since private sector investors were unwilling to invest in the poorly developed seed sector. Subsequent interventions have built networks of civil society organisations working in conjunction with private and public partnerships to create a social, economic and knowledge infrastructure for the emergence of private seed markets. The paper examines the narratives about seeds that inform and mobilise these networks for the development of commercial seed. It is argued that there is an inherent tension within seed development between the participatory networks of plant breeding and the commercial networks of seed certification and distribution. Participatory breeding is based on farmers' evaluation of new varieties, incorporation of farmers' varieties and knowledge into breeding and open access relations between breeders and farmers. Through these relations, farmers also gain access to unreleased varieties, which they experiment with and distribute through their own networks. In contrast with this, commercial networks are concerned with 'manufacturing' markets for seeds, where low demand exists and farmers usually multiply their own seeds. This results in strategies that see seeds as objects in themselves that can be appropriated, rather than as products of a largely public process of development. This results in narratives that portray commercial seeds as the panacea for the problems of farmers and depict the main constraints in agriculture as resulting from the lack of reach of commercial seed and agodealers into the rural areas. Thus a commercial Green Revolution is portrayed as the solution to food security issues in Africa. This approach, with its appeals to agricultural modernisation, is effective in mobilising support in the state, since state agricultural organisations are often embedded in agricultural modernisation paradigms. By stressing the importance of the private sector, these approaches appeal to the dominant neoliberal concerns in macroeconomic policy and the increasing power of agribusiness. However, the support of donors and new private foundations for building commercial markets and subsidising commercial seeds and the transaction costs of seed and input markets tends to lock farmers into agribusiness interests and contracts. The assumptions about markets and improved seed serve to marginalise and undermine both the participatory basis on which breeding was organised during the seventies, and the search for more creative and critical solutions to the constraints of agricultural modernisation in the diverse, risky and uncertain environments that characterise much of Africa. The paper examines the new narratives about seeds, the impact of neoliberal reforms on the seed sector, and the interactions and conflicts that characterise the various actor networks that constitute

seed development in a case study of the Northern Region of Ghana.

1. Introduction

Seed policy in Ghana is constructed around a series of interweaving narratives about food security, agricultural modernisation and technology diffusion. The commercialisation of seed generates debates about intellectual property rights, participation of farmers in technology development, and environmental concerns about protecting agrobiodiversity. In the era of liberalisation such policy debates are located within macroeconomic debates about the relationship between the public and private sectors and partnerships between state and industry, as well as the role of civil society participation in policy processes. Within different epochs these issues have been given different weight. They have been interconnected and coexisted in different ways, and some of these concerns have been marginalised and ignored as policy shifts to new frameworks.

Seed policy involves complex alliances between national, local and international interests, between agricultural sector coalitions and macroeconomic policies. In recent years the institutions of agricultural development have increasingly been shaped by the neoliberal concerns with facilitating the expansion of the market. However, most of the institutions concerned with cereal seed breeding and regulation in Africa were built in the post-war period, when they were embedded within an evolving international institutional framework of agricultural modernisation that developed within the UN system. This was anchored within a framework of state-led development rooted in Keynesian economics and the Marshall Plan. Within this system specialised international development agencies promoted a vision of rural development based on technocentric interventions concerned with introducing mechanisation, synthetic inputs and improved seeds.

Since the 1980s the framework of agricultural modernisation has shifted towards a focus on market-based development with state participation in creating an enabling environment and market regulations. This transition has occurred with a critique of both the state and agricultural modernisation –resulting from the early linkages between the two, which broadly emerged under the Washington Consensus. The main factors identified in this critique were constraints of bureaucratic top-down management techniques, elite capture of state policies, political distortion of policies, and urban bias (World Bank 1981; Bates 1981; Lipton 1977). However, with the breakdown of the Washington Consensus, this critique of the state and agricultural modernisation has evaporated and both have re-emerged as central to a vision of commercial privatised agriculture.

Seed policies have been structured by concerns around commercialisation and privatisation on one axis and around concerns of social equity and participation, farmers' rights and environmental concerns on another. However, while social and environmental concerns have been powerful forces that have mediated the role of the

state and created pressures for reform, the technocentric approaches of agricultural modernisation have continued to dominate agricultural science and development within the context of reforms rooted in notions of good governance. Thus, in the last fifty years agricultural policy has come full circle within sub-Saharan Africa - albeit on a different level - from a state-led Green Revolution in the 1960s to an alliance for the Green Revolution in the 2000s within a framework of civil society linkages with public-private partnerships to develop commercial markets in inputs and seeds.

The aim of this study is to understand the implications of these changes and transformation in seed policy; to analyse the complex factors that result in the making and remaking of seed policy; and the dynamics through which policies evolve, change and are challenged. The study traces the relationship between policy narratives about seeds, and the social and political networks that influence and shape policy. It examines the economic and political interests that underlie particular policy narratives and initiatives to control and regulate the production of seeds, and the institutional frameworks of seed production in Ghana. It examines how 'story-lines' (Hajer 1995) are elaborated to create policy coalitions to effect particular policy interests and draw boundaries around particular problems, which consolidate specific narratives while marginalising and excluding other voices. The study also addresses the extent to which policymaking is based on reflection and learning as opposed to rhetoric and reification of dominant institutional, political and economic interests.

The study works at three different levels. Firstly, it seeks to understand the main characteristics of the ways in which policy frameworks are framed, how this framing changes over time, and what the narratives about policy problems reflect and achieve. Secondly, the study seeks to understand the influences of wider macroeconomic policy processes on seed policies, and how institutional routines and learning are mediated by these processes or re-insert themselves into new contexts. This is addressed by examining changes in seed policy through a political economy lens that examines the transition from state-led development that characterised the post-war and early independence period to the neoliberal reforms of the early 1980s, and the public-private partnerships of the present era. Thirdly, the study examines the importance of actor networks and coalitions in shaping policy and policy implementation under economic liberalisation. This is approached by tracing the various actors involved in the transformation and regulation of seeds from breeding stations to farmers, and from farmers to other actors. This study investigates the perceptions of the various actors in their roles in the production of seed, the importance of seeds, and the major constraints in seed production is investigated.

Interviews were held with various actors involved in the seed production in both national and development institutions, NGOs, and the private sector in the second half of 2009 and early 2010. These interviews sought to elicit the main narratives about seeds that informed the activities of the various organisations and the actors

within them. These interviews elicited the roles and interests, linkages to other organisations, and the skills that various actors and organisations contributed to the management of seed. The interviews sought to reveal major constraints, bottlenecks, conflicts, and conflicts of interest in the coalitions concerned with promoting certified and commercial seed. A detailed case study was carried out in the Northern Region of Ghana in January 2010, involving interviews with government agencies, NGOs, research scientists, seed producers, and seed and grain traders. In addition to interviews with key actors in state and non-state organisations, a more formal survey was carried out in two villages, Kpalung and Dundo, in which 87 farmers were interviewed about the varieties of maize, sorghum and rice seeds they planted and their experiences with certified seed. Both settlements represent areas with high usage of inputs, in which farmers are more likely than in other more outlying areas to use improved seeds. Dundo is situated near the Nyanpkala Agricultural Research Station, in an area with easy access to new seeds and inputs. It is also characterised by considerable land pressures resulting from peri-urban residential development, which results in scarcity of land, permanent cultivation, and high use of inputs. By contrast, land pressures are less evident at Kpalung, but it is situated in one of the major cereal cultivation areas in the Northern Region, in close proximity to the Savelugu market.

The Northern Region is one of the poorer regions in Ghana, in which concerns with poverty reduction and food security are paramount. However the Northern Region has also been identified in policy circles as a potential breadbasket, in which commercial agriculture can be developed. Agricultural development in the Northern Region is characterised by a high density of NGOs, with a considerable attention to cereal crop development. This results in a contradictory framework of agricultural development which attempts to embrace community-based participatory agricultural development, poverty alleviation, and the promotion of commercial agriculture.

This paper first outlines the major narratives about seeds in Africa which frame the approach to promoting a Green Revolution based on technical interventions and commercial sector development, and the main counter-narratives and critiques of technocentric approaches. From there it examines the framing of seed policy in Ghana, and the influences of macroeconomic policy frameworks and dominant policy interests in the reframing of seed policy in different policy phases in post-war policy in Ghana. The third section of the paper examines the various actor networks involved in seed production in Ghana and how they have positioned themselves in the various struggles to win political influence in cereal seed policy processes and the commodification of seeds in Ghana, focusing on a case study of seed initiatives in northern Ghana.

2. Changing agricultural policy narratives: Framing the Green Revolution debate in Africa

Since the 1960s plant breeding has become increasingly privatised as the corporate sector has taken over agricultural plant genetic resources. By the 1970s plant breeding had been rapidly transformed from a largely public sector service with small breeding family firms to an industry under the control of transnational agribusiness (Kloppenborg 1988). The global expansion of commercial seed production coincided with the Green Revolution, with its focus on building up a demand among farmers for new certified seeds and synthetic inputs. This resulted in a heightened commercial interest in global genetic resources and pressures to commodify these interests in the form of patenting rights and intellectual property rights, and the rise of mergers as large agribusiness firms began to take over small specialised breeding companies. These developments had profound implications for crop genetic resources. The diversity of crop genetic resources in farmers' fields began to be eroded by the increasing dependence of farmers on purchased uniform modern commercial varieties. Agribusiness began to acquire rights to farmers' own varieties through intellectual property rights and government in the global south began to promulgate patent regulations that enabled seed companies to gain control over the use of local varieties by farmers. These tendencies were strengthened by the Trade-Related Aspects of Intellectual Property Rights (TRIPs) Agreements of the World Trade Organization (Roffe 2008; Aoki and Luvai 2007; Aoki 1998; Kloppenborg 1988). By the 1980s concerns around the erosion of the diversity of seeds and intellectual property rights became manifest in the growth of NGOs, such as Rural Advancement Foundation International (RAFI, now ETC Group) and Genetic Resources Action International (GRAIN) and other civil society organisations lobbying for farmers' rights to their own varieties and against the genetic erosion characteristic of modern agriculture.

Some researchers and NGOs have argued that Green Revolution approaches have undermined farmers' ability to manage their own agroecosystems and in the process of introducing standardised variety threaten biodiversity. For instance, GRAIN has argued:

The real tragedy of the Green Revolution is that it undermined, and in many cases destroyed, farmers' practices based on diversity. In its push for uniformity it not only destroyed much of the diversity of genetic resources in the farmers' fields, but it also disrupted the sophisticated biological chains that form the basis of any sustainable agriculture. In all this, it affected profoundly the capacity of millions of farmers to survive with the limited means at their disposal. By moving technology from village to laboratory and germplasm from field to genebank, the Green Revolution has tended to reduce farmers'

control over their own production systems. (GRAIN 1992:5)

GRAIN advocated the strengthening of informal sector research based on farmer associations and NGOs, and support (with resources and tools) to strengthen their innovations in genetic conservation and breeding.

By the 1990s, concerns with agroecological diversity became merged with political economy approaches arising in the context of the increasing concentration of agribusiness monopolies and their growing control over seed production and intellectual property rights of seeds. Baumüller and Tansey (2008) have argued that the future of modern varieties depended on being able to access a wide variety of genetic materials to create future varieties that responded to unforeseen circumstances. Genetic re-engineering (biotechnology) and ex-situ collections of genetic resources are seen as simplistic solutions to this problem. In-situ diversity of genetic materials needs to be retained, and this can only be achieved by supporting the knowledge of farmers and their experimental capacities. The private sector cannot be relied upon to protect this diversity, since its interests are the major factor undermining genetic diversity. Thus, public sector research linked to community-based programmes is of critical concern in preserving genetic diversity. Pressures from NGOs and disquiet among some prominent crop scientists about the ways in which the agendas of international genetic resource agencies were increasingly becoming defined by the corporate world (Bennet 2002) led to international debates within the UN system about intellectual property rights. These debates eventually resulted in the recognition of farmers' rights in the International Undertaking on Plant Genetic Resources for Food and Agriculture at the FAO in 1983.

Corporate pressures continue to exert considerable influence over international genetic resource institutions, and in recent years their commitments to promoting the commercialisation of seed and intellectual property rights have become even more pronounced. Many aspects of Farmers' Rights have been eroded by the TRIPs Agreement (Aoki and Luvai 2007). NGO and civil society participation in international genetic resource forums have become less prominent. However, a large opposition to the increasing commercialisation of seeds and agriculture continues to grow in social movements espousing food sovereignty and open access genetic resources, and a growing mistrust of the food industry and international food policy (Scoones 2008; Freidman 2005).

Attempts to promote a Green Revolution within sub-Saharan Africa in the 1960s largely turned out to be a failure. New technologies and cultural practices worked out on favourably endowed agricultural experimentation stations frequently failing to perform under the agroecological conditions of smallholder farmers. Initially, failure and reluctance of small farmers to take up the technological prescriptions were ascribed to the backwardness and conservatism of small farmers. Agricultural extension policies focused on promoting uptake by a small cadre of 'elite' or 'progressives' farmers who, it was

theorised, would provide a demonstration effect to the poor farmers, resulting in the trickle down of new technology. Although new paradigms began to transform the theories of agricultural development from the 1970s and 1980s, the technology transfer modes of the Green Revolution continued to dominate mainstream national agricultural and extension services in Africa.

However, even by the 1970s a number of researchers began to question the Green Revolution technical fix approach in 'resource-poor' farming systems and the 'trickle down' model. They argued that the technologies did not succeed because they were inappropriate. They began to model the conditions, decision-making, and strategies of smallholders in 'resource-poor' rainfed environments, examining how farmers managed risks by diversifying into multiple cropping strategies. They recognised that African farming systems were frequently adapted to the varied and erratic climate, utilising a mixture of crops, including drought-tolerant varieties to ensure some harvest if rains failed. Research showed crop diversification also reduced vulnerability to pests and diseases and optimised the use of labour and other inputs (Norman 1974).

This heralded the beginnings of farming systems research (FSR) and later of farmer participatory research (FPR), which sought to involve farmers in research to enable research institutions to fine-tune their end products and research strategies to the needs of farmers. FPR involved farmers in crop development and breeding programmes, to evaluate trials and new varieties and technologies, and to help researchers tailor these to existing farming conditions (Farrington and Martin 1988; Chambers 1983; Rhoades and Booth 1982). During the late 1970s farmer participatory research became institutionalised in international research centres from where it was introduced into national crop development and seed breeding programmes. Farmers also contributed to internationally-driven research through the collection of germplasm from their own varieties, which were used in breeding new improved varieties in international centres. This led to a new appreciation of 'indigenous technical knowledge' and of the potential of farmers' knowledge in contributing to agricultural development.

Richards (1985) has argued for an approach that goes beyond co-opting farmers to participate in the existing programmes of researchers. He advocates for less emphasis on introducing improved varieties and new farming technology, and more emphasis on strengthening farmers' own informal research and development in the ecological diversity of West Africa. He has recently elaborated this into the concept of 'unsupervised learning' based on model of adaptive learning in seed systems and social networking among poor farmers. He argues for an approach based on creating appropriate genetic high tech for farmers, to facilitate enhanced learning within farmers' own institutional configurations and knowledge contexts. (Richards 2009) He and his associates have argued that while the Africa Rice Centre (WARDA) and its then Director General, Monty Jones, has received much accolade for the introduction of Nerica

rice varieties, which is based on a hybridisation of African glaberrima varieties with Asian sativa varieties, farmers had already developed such rice ideotypes in Sierra Leone over the past thirty years. These had been rapidly spread among farmers' networks. Farmers had discovered natural hybridisation within their fields and harnessed this to produce new varieties long before WARDA had discovered the technology (Barry et. al. 2007; Nuijten 2005; Monde and Richards 1992).

The period in which new participatory approaches began to be integrated into African research and development organisation coincided with the world recession of the 1970s, the crisis of the African state, and the adoption of structural adjustment. Divestiture of agricultural services was a major focus of adjustment policies in Africa. As a result of this, the thrust towards reform of state agricultural services based on a critique of agricultural modernisation were seriously curtailed, and the main directions of agricultural policy were geared towards the privatisation of agricultural services, promotion of export-oriented sectors, and agribusiness investment in agriculture. NGOs were increasingly funded as service providers that filled in gaps left by declining state institutions. Eicher (2003) has argued that the rise of NGOs in this period and growing environmental concern resulted in a diversion of donor funding from agricultural research to other sectors. In 2000 the World Bank reported its lowest level of support to agriculture in its history.

Within the context of structural adjustment one of the major agricultural sector interventions within Africa was the Sasakawa Global 2000 (SG 2000) initiatives, which sought to provide financial support for the maintenance of high input agriculture and certified seeds, by providing loans to farmers that would enable them to gain access to affordable inputs. This enabled state extension services to continue to function in the period of transition to commercial sector operations. The SG 2000 programme was designed by Norman Borlaug and Swaminathan, the architects of the Asian Green Revolution, with support from Sasakawa Foundation in Japan and the Jimmy Carter Center in the United States. SG 2000 continued to support the values of the Green Revolution. SG 2000 was greeted with much scepticism by researchers working within the FSR tradition, but it had considerable financial backing to achieve a highly visible presence in many African states. However, by the early 2000s the programme floundered, as loan recovery programmes began to fail as farmers had to increasingly adjust to market forces.

During the 2000s there has been a resurgence of Green Revolution narratives in Africa, which are being promoted by a number of high profile organisations with significant sources of funding and access to high levels of policy making in the US, international policy agencies, and within African states. The idea of a return to the Green Revolution in Africa have been front-lined by Jeffrey Sachs, Pedro Sanchez, Kofi Annan, the Bill and Melinda Gates Foundation, and given considerable support by the Millennium Challenge Corporation (MCC). As Director of the UN Millennium Project from 2002-2006, Sachs became special advisor to the then Secretary General of

the UN, Kofi Annan on the Millennium Development Goals. Sachs founded the Millennium Villages Project, which was concerned with ending poverty and hunger in various parts of sub-Saharan Africa through technical interventions in agriculture, medicine and education. In agriculture, Sachs advocated the use of improved seeds, irrigation and fertiliser to increase crop yields by three to five times and thus reduce hunger and poverty (Sachs 2005). His ideas were taken up by eminent agricultural scientists, including Pedro Sanchez and M.S. Swaminathan, who have acted as joint coordinators of the Millennium Project. They argue for an expansion of investment in agricultural research and development, and increasing provision of synthetic inputs and improved seeds to farmers. They argue that communities needed to be 'empowered' with science-based technology to end hunger and poverty.

Within the context of declining yields in agriculture in East Africa during the early 2000s and the world food crisis of the mid 2000s, these later day adherents of the African Green Revolution have framed interventions to increase use of inputs and certified seeds as a food security response. They argue that access to affordable inputs will enable rural Africans to meet their food needs through access to modern technology, rather than through reliance on food aid. The heralded success of Malawi, under the influence of Sachs' programme, in raising food production through providing access to credit support and a 75 percent subsidisation of seeds and inputs has resulted in the rapid dissemination of this approach as a response to the world food crisis. However, these new input subsidy packages have been adapted to the political realities of economic liberalisation. The approach advocates building linkages between rural communities and markets, by making 'markets work for the poor' and building up networks of agro-dealers, input suppliers, private seed companies, linked with agribusiness, and by creating infrastructural support for agricultural markets to reach and serve smallholder farmers (Sanchez et. al. 2005). This ingeniously enables food security concerns to be integrated into policies that promote the expansion of the market within the vision of the Post-Washington consensus. This includes partnerships between private, public and civil society sectors to build up agricultural markets that respond to the main demands and interests of agribusiness interests in Africa¹. The policy has also gained the support of many African states, which can now re-activate bureaucratic routines in agricultural services associated with agricultural modernisation, within the new context of supporting commercial agricultural development and making markets work.

These ideas have gained further credence with support from the Bill & Melinda Gates Foundation for the Alliance for a Green Revolution in Africa (AGRA), with Kofi Annan as the Chairman of its Board. AGRA has access to considerable finances with which to implement its programme and significant influence in political and corporate sectors. AGRA is committed to supporting the development of the institutional framework for plant breeding within Africa by supporting research and

training in plant breeding, increasing the capacity of breeders to create new commercial varieties adapted to diverse, risky and fragile environments, encouraging governments to create new seed legislation favouring the privatisation of seed breeding, and building new biotechnology capacities. This takes place within the context of supporting the development of private seed markets, seed companies, commercial seeds, agrodealer networks and input suppliers. The Millennium Challenge Corporation (MCC), a grant disbursing body of the US government with an independent board in which private sector interests are well represented, - has also been disbursing grants to African states for commercial seed promotion. In 2008 it developed a Memorandum of Understanding with AGRA for agricultural policy change support in Africa. While food security figures largely in the rhetoric of these organisations, the interests of agribusiness in standardised seeds, quality control, and seed markets are well represented and have influenced the promotion of certified seeds.

In recent years new development networks promoting Green Revolution technologies and commercial markets in certified seeds and inputs has become increasingly dominant in Africa. While this approach claims to be pro-poor and pro-smallholder, it effectively integrates farmers into the agendas of agribusiness rather than providing farmers with options and independent choices about incorporating inputs into their own farming strategies. Contemporary Green Revolution approaches assume that market-based solutions are the panacea for the ills of African agriculture. They have tended to displace the more visionary and radical participatory approaches that developed in the 1970s, which sought to foster a more creative agenda based on Farmer First approaches (Chambers 1983), farmers' own knowledge and learning (Richards 2009), a creative relationship between farmers and public science (Ashby 2009; Almekinders and Elings 2001), or a critique of the commodification of agriculture and the threat that transnational monopolies of seeds present to agrobiodiversity and the future of farmers own varieties (Kloppenborg 1988).

The next section examines the ways in which the cereal seed system in Ghana has been shaped by wider political and market interests, and the impact of the new African Green Revolution on the changing priorities in cereal seed policies. It examines the changing institutional configuration of seed breeding and regulation under different political and policy regimes and the coalition of interests that emerge in different periods.

3. A political economy of seed policy and agricultural modernisation in Ghana

Although the focus of this study is on recent policies within the seed sector under liberalised markets, a historical understanding of the political economy of policy processes greatly enhances our understanding of contemporary policy issues. In their bid to impose 'market solutions' on policy processes, neoliberal frameworks

tend to caricature the era of state led development as associated with corruption, political distortion and gross mismanagement without any logic beyond the quest for political hegemony. This tends to blur any analysis of the relationship between the state and agricultural modernisation, beyond the assumptions and polemics of the ills of state-led development and an ideological affirmation of economic liberalisation.

Agricultural policies have gone through four clear phases in Ghana. Firstly, a phase of state-led development within a vision of agricultural modernisation, in which the state began to build the basic infrastructure for a modern synthetic-input based mechanised agriculture. Secondly, a phase of nationalist commercial development with support for large-scale estate farmers and small-scale contract farmers. Thirdly, a phase of economic crisis marked by structural adjustment, retrenchment of state agricultural services and privatisation. Most recently is the phase of agribusiness development, marked by donor support for the state to make investments in basic agricultural infrastructure, and institutional reforms to create an enabling environment for private sector development and attract private investments in agricultural services and markets. This section attempts to understand the logic of developments within cereal seed research and systems within these distinct periods. It aims to understand the ways in which policy issues have evolved, the main coalition of interests that have developed around policies and created pressures for transformations, and the main constraints within different policy frameworks that have also created pressures for change.

Ghana can be broadly divided into two zones: a humid high forest and a savanna zone. During the early colonial period most development occurred within the high forest zone, which became the largest cocoa producer in the world by the 1920s. The savanna zone was integrated into the colonial economy as a labour reserve for the south. As a result of the rapid expansion of monoculture cocoa cultivation in the forest, the forest zone became a deficit food producer. Meanwhile, the potential major food production area in the country, the north, was constrained by outmigration and lack of support for agricultural development. From the 1950s development policies have attempted to transform the north and the transition zone into a major food production area. With the decline of the state in the 1970s and 1980s under structural adjustment, NGOs emerged in the north as major actors involved in agricultural services delivery. In recent years a major focus of development initiatives in the north has focused on integrating producers into commercial agribusiness chains, and building private-public partnerships to provide commercial agricultural services for farmers.

3.1. The colonial origins of agricultural modernisation

A policy of active state engagement in the development of food crop production in Ghana only became implemented after the Second World War. Faced with serious shortages of raw materials and lack of finances, the British government turned to Africa as a source of non-dollar

markets and potential dollar-earning commodities (Cooper 1996). Before this, agricultural policy had mainly focused on cocoa production within the high forest zone. The north formed a labour reserve for southern cocoa, and the main concerns of colonial policy were to halt the development of commercial markets within this area and preserve communities against the socially disintegrating impacts of development (Grischow 2006). The major agricultural interventions were concerned with soil, water and forest conservation, with regulating farming practice rather than intensifying production. During the 1940s a major concern in colonial policy circles was the increasing importation of foods, particularly of vegetable oils (Cowen and Shenton 1994). During the Second World War the British government created a West African Produce Control Board (WAPCB), one of whose aims was to stimulate the production of groundnut oil and palm oil for British wartime provisioning. After the war an Agricultural Products Marketing Board was formed in the Gold Coast. Since the forest zone was largely engaged in the production of cocoa for export, the colonial government set about transforming the Northern Territories of the Gold Coast into a major exporter of groundnut for export and producer of commercial food. Through increased production of vegetable oils and food, the colonial government sought to provide raw materials for British industry and minimize imports of food products into the Gold Coast, to enable favourable balances of trade to be created which could be used for postwar construction in Britain (Grishchov 2007).

During the 1940s a number of technical innovations in agricultural research in food production occurred. Strictures on importing food and social unrest in the south encouraged the colonial government to attempt to stimulate rice production in the north during the 1940s. An epidemic of rust disease in maize resulted in the introduction of rust-resistant varieties from Latin America (McCann 2005). By 1950 the main emphasis in agricultural policy was promotion of agricultural modernisation and a number of agricultural experimental agricultural stations were established throughout the country in both forest and savanna. These experimental stations established trials on crop rotations, input applications, and the performance of new varieties collected from the British Empire and other sources.

In 1950 the colonial government initiated a large-scale mechanised agricultural project, managed by the Gonja Development Company (GDC), in the sparsely populated Damongo area of the Northern Territories on 30,000 acres of land. The project sought to resettle 80,000 peasant farmers from the densely populated Zaurungu district to the north (Grischow 2007; Konings 1986). The project combined a commitment to mechanised groundnut cultivation with collectivised peasant labour within a vision of community development. This created a development corporation between the state and peasantry that sought to co-ordinate peasant production along communal and co-operative lines. It also sought to preserve community identities and ensure that social differentiation and the emergence of capitalist elements

within the farming population would not result in social disintegration and the emergence of a landless class and urban drift. Private capital was excluded from investing in the project on the grounds that it would politically destabilise peasant production (Grischow 2007). However, this vision of community development within agricultural modernisations was a failure, and the GDC collapsed as the resettled farmers abandoned the project, and major problems emerged in every stage of production. The GDC was liquidated in 1957. While agricultural modernisation was initiated within late colonialism, the relative lack of development of food crop farming in earlier eras meant there was a lack of an accumulating class of farmers. Thus the colonial authorities attempted to implement agricultural modernisation as a community development initiative, which sought to raise food production within collectives of peasant cultivators who were mobilised by the state on co-operative lines.

With the attainment of independence, the nascent structures of agricultural modernisation were built upon by the Nkrumah led Convention People's Party (CPP) government. The colonial experimental stations formed the nucleus for the emergence of state agricultural research and production organisations around which a state bureaucracy developed. These were rooted in the practice of agricultural modernisation, stripped of its community development framework.

3.2. State interventions in agricultural during the 1960s

Rising food imports during the 1960s and falls in cocoa prices compelled the government in the early independence period to invest resources in encouraging food production through mechanisation and use of inputs. However, this continued to be a highly experimental form of agricultural production, since blueprints for agricultural modernisation under African conditions did not exist. The state organised a number of 'production fronts' including state farms, workers brigade farms, and cooperative farms on which the majority of the agricultural budget was expended. The transitional and northern savannas became the major focus for mechanised food production, since large areas of cheap land was easily acquired by the state without dispossessing large numbers of farmers, and without displacing existing export crop sectors from which government derived significant revenues, such as cocoa. Thus, the major policies in this period aimed to transform the northern part of the country into a producer of food crops and industrial raw materials for the south, through state investment in mechanised agriculture.

Attempts to develop a modern seed sector began in 1958 with the creation of the Hybrid Maize Production Unit. However, difficulty in producing hybrids led to a refocus on open-pollinated varieties in 1961, when the unit was renamed the Seed Multiplication Division (Delimini and Wobil 1998). In 1964 a Crop Research Institute (CRI) was created at Kwadaso, under the Ghana Academy of Sciences (later to be renamed the Council for Science and Industrial Research), which became the centre for research into food crop varieties for the south.

Nyankpala emerged as the major experimental station for trials in the northern savanna area. The major focus of research was in identifying promising composite varieties from international sources, which could be multiplied for distribution to farmers and the state agricultural sector. There was a major recognition that farmers wanted seeds they could multiply rather than expensive and unproven hybrid varieties:

The main breeding objective during the year was directed towards the development and testing of composite varieties of maize with higher yield and agronomic varieties. The purpose was to satisfy marginal and less progressive farmers who tend to grow the recommended hybrids for more than one generation with a resulting drastic decline in yield. Unlike the hybrids, the composites may be grown for 2 to 3 years without a serious reduction in yield. The farmer may thus raise his own seed by simple mass selection for 2 to 3 years before purchasing fresh seed. (CRI 1970:2)

Research on rice included the collection of local varieties and, promising international varieties, and then testing these varieties with various combinations of inputs to work out an optimal recommendation. During the 1960s, the Annual Reports of the CRI reveal that about three hundred different rice varieties were being experimented on within the various agricultural experimental stations in south and north. Trials on sorghum involved comparisons between selected sorghum hybrids and local varieties.

In the 1960s and early 1970s the CRI was beset by a number of problems. The first major problem was lack of skilled staff. In the early 1960s CRI lacked a trained agronomist. Research and Technical Officers largely carried out breeding programmes. Field trials were also beset by a number of problems that made it difficult to undertake accurate experiments. This included pest attacks, of which the most notable was the armyworm, and cycles of drought and flooding, which all affected yields on experimental plots. The reproduction of genetic materials also proved to be problematic, with many improved varieties being outperformed by local varieties, as the improved varieties began to rapidly deteriorate through inbreeding. Thus, according to the 1970 Annual Report of the CRI, the failure of the improved variety Nyankariwa 1 to outperform local varieties 'would seem to indicate a considerable deterioration of this synthetic, which is not surprising since Nyankariwa 1 was synthesized more than 7 years ago' (CRI 1970:18).

The mandate of the CRI was to identify promising varieties for multiplication. The multiplication and dissemination of seed was carried out by the Seed Multiplication Division of the Ministry of Agriculture. This had the mandate to obtain recommended varieties of materials for multiplication and distribution to farmers, to liaise with extensions services to introduce improved varieties, and to plan in consultation with the CRI for the importation of improved seed into the country. The multiplication of seed was a major activity carried out by the state farms.

The major policy interventions within this period sought to build up the basic capacities of state services to deliver inputs and quality seed distribution. Major initiatives involved the training of technical staff, graduate and post-graduate training of research staff abroad, the expansion of linkages with the embryonic international agricultural services, and the development of new institutional practices. Although most investments in agriculture focused on the state, these had unintended outcomes on the surrounding farmers. The development of a transport infrastructure and technical services supporting state organisations facilitated the development of commercial markets around the state farms and the movement of aspiring commercial farmers into these areas (Amanor and Pabi 2007). This rapidly created a demand for modern agricultural services and support among aspiring commercial farmers, which was to also result in a critique of state farms and a demand for state services supporting commercial farmers. However, given the constraints of the early independence period, it is difficult to envisage any other course that could have been taken within the framework of the central tenets of agricultural modernisation, other than the building of basic public sector investment in agriculture, given the absence of an agricultural commercial class outside of the cocoa sector.

3.3. State policies towards commercial and smallholder sectors in the 1970s

With the overthrow of Nkrumah in 1966, the National Liberation Council (NLC) military government and the subsequent elected Progress Party (PP) government under Busia introduced a 'Stabilisation and Consolidation' programme in 1966-68, with the support of the International Monetary Fund (IMF). This favoured private sector investment and the divestiture of state farms. It discouraged direct state investment in food production. State investment was to be limited to sectors that were unattractive to the private sector, to enterprises producing raw materials for agroindustries, and those that required long-term investments. The Two Year Development Plan (1968-70) laid the foundations for the promotion of commercial agriculture in the transition zones and the north. This followed the UNDP and FAO Green Revolution approaches, importing large amounts of inputs and tractors, which were distributed to farmers through extension services at highly subsidised rates. An integrated extension programme was launched as the Focus and Concentrate Programme, which was mainly directed towards the 'progressive farmer', who were given access to inputs, tractors and favourable loans (Shepherd and Onumah 1997; Konings 1986; Delimini and Wobil 1998; Tripp and Marfo 1997). In 1969 seed multiplication was tended out to contract growers, closely supervised by the Ministry of Agriculture (Delimini and Wobil 1998; Tripp and Marfo 1997). The Ghanaian-German Agricultural Development Project (GGADP) was founded in 1970 to improve agricultural services in northern Ghana. Like all the other agricultural programmes of this time the GGADP largely focused on promoting commercial rice production.

In 1972 the PP government was overthrown by a military coup, which brought the National Redemption Council to power. This continued to build upon agricultural policies that promoted commercial food production, and facilitated the emergence of large commercial farmers who were supplied favourable loans and subsidised inputs. Subsidies on fertilisers rose from 50 percent in 1970 to 81 percent in 1976 (Shepherd and Onumah 1997). By the 1970s a significant sector of large estate capitalist farmers had emerged for rice production in northern Ghana and to a lesser extent for maize production in the transition zone, around the state farms in Wenchi, Branam and Ejura. Provision of subsidies and favourable loans to large-scale capitalist farmers was expected to result in a significant rise in food production for the urban market. However, this sector did not prove to be viable. Investments in large-scale estate farms was risky and in the context of erratic rainfall during the 1970s and the related increasing spread of bush fires into farms, many commercial farmers lost their crops and were unable to pay back loans they had taken from the banks (Shepherd and Onumah 1997; Konings 1986).

By the mid 1970s, with increasing economic crisis exacerbated by the world economic recession, the oil crisis and poor rainfall, the government was no longer able to provide high rates of subsidisation of agriculture inputs. Shortages of capital within the banking system resulted in the decline of loans to commercial farmers. Government could no longer depend upon large farmers to provide state marketing corporations with cheap food at government designated control prices. Many commercial rice farmers began smuggling their crop across borders. In 1980 only 21,000 tonnes of rice paddy was officially produced, resulting in a large gap of 79,000 tonnes, between production and consumption, which was met through import and food-aid grants (Konings 1986). A major element in the economic crisis emanated from the credit collapse of banks in 1979, which partly resulted from the failure of large rice farmers to repay loans. The IMF stabilisation programme included the introduction of fiscal discipline, the divestiture of state agricultural production and marketing agencies, the cessation of state fertiliser and input distribution, and the removal of subsidies on agricultural inputs. This effectively resulted in the collapse of large-scale commercial agricultural estates, which became starved of state support, and cereal production largely became the domain of smallholder producers during the 1980s.

However, from the mid 1970s, before the implementation of structural adjustment, the state began to reorient its agricultural policies towards promoting foreign capital investments in joint agribusiness ventures, and state run agricultural project with smallholder contract or group farmers. These policies followed the World Bank smallholder approach, of facilitating commercial smallholder development by integrating smallholders into projects that provided them with inputs, new seeds, and prescribed cultural recommendations supervised by project staff and extension services, and tied producers into markets frequently controlled by parastatal organisations (Daddieh, 1994; Konings 1986). These projects often

had coercive features and farmers who did not conform to the top-down management prescriptions could be ejected from the project (Botchway 1993; Konings 1986). Echoing the peasant-mechanised collectives of latter day colonialism, the smallholders were often organised into groups. Some of these projects have been the forerunners of major private sector agribusiness ventures, particularly in the oil palm sector, which were sold off to foreign investors following structural adjustment (Amanor 1999).

This latter smallholder focus fell into the broad prescriptions of international agricultural research, and resulted in expanding linkages between Ghanaian agricultural research services and the World Bank, the International Institute for Tropical Agriculture (IITA), the International Maize and Wheat Improvement Centre Maize (CIMMYT), International Rice Research Institute (IRRI) and the Africa Rice Centre (WARDA). These linkages made possible the rapid expansion of seed breeding capacity in Ghana, access of breeders to training in international centres, and access of Ghanaian breeders to a wide range of genetic resources collected by international centres, including many farmer varieties. Ghanaian plant breeders were able to screen these varieties for their potential in different environments in Ghana and to cross them with other varieties adapted to local conditions. Ghanaian breeders also began to develop participatory trials and farmer evaluation of varieties as a method for fine-tuning of improved varieties.

In 1979 this research capacity was enhanced through the initiation of the Ghana Grains and Development Project (GGDP), with support from the Canadian International Development Aid (CIDA). This created a new institutional research structure for the improvement of cereal crops and legumes, which addressed plant breeding within a multidimensional context. This included issues concerned with yield, disease and pest resistance, adaptability to different ecological conditions, different maturing periods, and lodging. The GGDP initiated a programme of on-farm trials and demonstration plots conducted by research and extension agents, to adapt varieties and recommendations to farming conditions, and demonstrate and rapidly disseminate new varieties to farmers. This has facilitated the rapid release of new varieties during the 1980s and 1990s (Tripp and Marfo 1997).

During the 1970s, German Technical Cooperation (GTZ) supported the development of research capacity at the Nyankpala Agricultural Experimental Station (NAES) and institutionalised a focus on farming systems research (FSR). In 1994 NAES was transformed into an autonomous agricultural research institute with a mandate to develop crops adapted to the northern regions, and renamed the Savanna Agricultural Research Institute (SARI). This has enabled the agricultural research system in Ghana to effectively adapt seeds to specific agroecologies. CRI in Kumasi specialises in crop adaptation in the forest zone, and SARI in the savanna zone.

The development of adaptive seed breeding has encouraged the institutionalisation of participatory strategies and farming systems research. Successful adaptive

breeding strategies required an understanding of the constraints within existing farming systems; the criteria which farmers use to evaluate varieties; and the traits of existing farmers' varieties, including both those related to morphology and to post-harvest qualities of seeds. However, this has tended to be carried out within a pragmatic technocentric framework, in which participation constitutes a technicist approach to conducting trials to produce better seeds, rather than a means of empowering farmers to exercise choice and make demands upon services. While the move towards a smallholder focus in agricultural policy in the mid 1970s facilitated the development of participatory approaches, these were implemented in a top-down fashion that sought to integrate producers into existing state projects rooted in agricultural modernisation.

3.4. Participation, privatisation, and the rise of civil society in agricultural policies in the 1980s and 1990s

The economic crisis of the late 1970s forced the government to seek assistance from the IMF and implement a structural adjustment programme that had major effects on the public agricultural sector. Government agricultural parastatal organisations and services were divested and privatised. However, many of these organisations were not in a healthy state or in a mature phase of development. Thus divestiture did not result in the intended outcome of privatisation. Potential investors were unwilling to invest in agricultural or agricultural services in Ghana under existing conditions, until government invested in creating an enabling environment for agriculture. As a consequence of this agricultural services declined and receded.

Under the conditionalities of structural adjustment, the Government of Ghana ceased procuring, distributing and subsidising fertilisers in 1989 and the fertiliser trade became privatised. During the same period, foreign exchange markets were liberalised. The national currency began to slide and inflation rates exceeded 25 percent throughout the 1990s. Interest rates on agricultural loans from the banks rose to between 30-40 percent. The prices of fertilisers rapidly increased, resulting in a pronounced decline in fertiliser use on food crops. Fertiliser imports averaged just over 4,000 tonnes during the 1960s and rose to 58,650 tonnes in 1979. Following removal of subsidies, fertiliser imports declined to 20,100 tonnes in 1986 and fluctuated between 35,000-55,000 tonnes during the 1990s and early 2000s (Shepherd and Onumah 1997). This decline of fertiliser use has had an impact on the use of improved seed, since their potential higher yields only occurs with applications of recommended dosages of synthetic fertilisers.

During the same period attempts were made to privatise certified seed production. In 1980, prior to structural adjustment, the Ghana Seed Company (GSC) was established, with considerable support from the United States Agency for International Development (USAID), as a parastatal concerned with the production of certified commercial seed. The Ghana Grain and Legume Board (GGLB) was concerned with defining seed production

targets, regulating seed production, and producing seed. The GGLB was assigned the task of producing foundation seed, while the Seed Company was mandated to produce certified seed. This creation of national institutions for seed production occurred during the period of adoption of structural adjustment and the privatisation of state agriculture. Donor support for seed production was reluctantly given in the context of creating a viable commercial company, which could then be privatised. The ten years of operation of the GSC were plagued with problems of quality of seed, low outputs of seed, and low returns to capital investment (Tripp and Marfo 1997). As a consequence of its poor performance in a macro-environment not supportive of parastatal development, the GSC was closed down, restructured and 'privatised' in 1989. However, the government was unable to attract large-scale investors into the seed sector, and this 'privatisation' has taken the form of transforming the seed growers employed and contracted by the state into private sector small growers. The private growers are still dependent upon the state to provide them with contracts for their production, and their activities are partially subsidised by the state, which processes their seed at low costs.

Given the reluctance of the private sector to move into agricultural sector provisioning, donors began to finance NGOs to provide intermediary gap-filling services within the agricultural sector. This was often promoted as facilitating local participation in development. Two distinct types of NGO activities within the agricultural sector developed during the 1980s and 1990s. The first arose out of responses to the Sahelian drought in the seventies and the need for food security. This was oriented towards providing services for the rural poor. This often was inspired by environmental concerns of enhancing the environment to stabilise yields, through tree planting and soil and water conservation. Implicit in this approach was a critique of agricultural modernisation, which was seen to have failed to address environmental concerns or the needs of poor farmers. The advocates of this approach often developed alternative agricultural technologies for the poor and a sense of the importance of indigenous knowledge, promoting technologies such as bullock ploughing, soil bunding, water harvesting with stones, composting, and community seed banks. Proponents of this approach in Ghana included the Presbyterian and Catholic churches, which by the early 1980s had well developed agricultural stations throughout the north. By the 1990s, these church-based NGOs came together to form the Association of Church Development Projects (ACDEP) (Alebikeya 1993). These were linked into international networks, sponsored by such organisations as the ETZ foundation in the Netherlands, which promoted alternative cultural, spiritual and ecological approaches to agriculture. In its newsletter, *Compas Magazine for Endogenous Development*, Millar et al. (2001:4) defines the aim of the *Compas* programme as:

to support rural people to appreciate, test and improve their own knowledge, values and practices.

Compas emphasises the local ownership of knowledge and supports the capacity of local people to learn and experiment, in order to strengthen their cultural identity and improve livelihoods... The experiences and insights gained in this process are shared between partners and other development professionals in order to stimulate an intercultural dialogue and support cultural diversity.

In many ways these church-based associations looked back to the community approaches and technologies that had developed under colonialism (with their emphasis of protecting local cultures through indirect rule), before they were displaced by agricultural modernisation. NGOs working in community participatory knowledge-based activities have also built up working relations with researchers. For instance, David Millar, a prominent member of the *Compas* network, is also a professor at University of Development Studies (UDS). Most significantly, within the seed sector, ACDEP has built up linkages with plant breeders to facilitate community seed production programmes.

The second type of NGO activity was concerned with filling in the gaps arising from the retreat of donor funding from state-led agricultural development and preparing the transition to privatisation. These NGOs were concerned with defending and promoting agricultural modernisation and ensuring its continued relevance to national development. The most significant NGO programme in this category was SG 2000, which operated in several African countries between the mid 1980s to early 2000s. With close links to high political circles and major agribusiness companies, SG 2000 was able to build close linkages within African political circles and win support for implementing its programme within agricultural extension services in 11 African countries.

The pioneering SG 2000 programme was introduced in Ghana in 1986, at the height of the crisis in input supply brought about by restructuring. The SG 2000 programme distributed inputs and seeds to farmers at low interest rates with the support of Ministry of Agricultural extension services. The project established large demonstration 'production test plots' (PTPs), in which selected farmers were encouraged to compare the performance of improved crop and inputs against their own technologies. The project focused on maize and sorghum production in Ghana, using the new variety of Quality Protein Maize (QPM), Obatampa, produced by CRI in Ghana, and Framida, a new variety of sorghum produced by SARI in the north. The programme rapidly expanded from 1,600 PTPs in 1987 to 76,000 PTPs in 1989 (Tripp and Marfo 1997). The demonstration plots also served as seed multiplication units and participating farmers sold their seed to SG 2000. Obatampa seeds produced in Ghana were also exported to SG 2000 programmes in other African countries, creating a significant demand for Ghanaian QPM. Although, the SG 2000 programme was successful in promoting uptake of new varieties and fertilisers, once the three years of credit offered farmers without repayment expired, many farmers reverted back to low input cultivation, rather than continue to purchase improved

seed and fertiliser on the market. By 1989 SG 2000 began to experience difficulties in loan recovery and by 1990 loan recovery had dropped to 45 percent.

In 1990 the SG 2000 programme was restructured in line with the privatisation of agricultural services. Agricultural Extension Services were no longer responsible for input distribution agricultural services and SG 2000 worked with the newly created Ghana Seed Inspection Division (GSID) to develop a network of private seed producers, which evolved into the Seed Producers Association of Ghana (SeedPAG). SG 2000 diversified into rice, cassava, cowpea and soybean production, devised a programme to promote the development of private input dealers, and added conservation tillage technologies to its repertoire, based on chemical herbicides developed in collaboration with Monsanto. A credit scheme was introduced in 1991, involving the Agricultural Development Bank (ADB), input dealers, and newly registered farmers associations. Approved farmers received input packages from approved suppliers, who were remitted by ADB. After harvest, farmer groups were responsible for paying their loans to ADB. The programme ran from 1991-1999, but began to falter in the mid 1990s as SG 2000 funding of the transaction costs of this programme declined. With increasing input costs loan recovery began to decline. By 2003 SG 2000 programmes in Ghana were closed down. During its period of operation from 1986-2003, SG 2000 spent US\$20 million in its programme in Ghana. SG 2000 provided an important impetus for the development of commercial seed production in Ghana and use of inputs in a period of escalating costs, which made input use uneconomic for many farmers. It facilitated the expansion of private networks of seed growers and input dealers. However, the programme was unable to create stable conditions for input usage.

Claims have been made that the SG 2000 has been a success, measured in terms of increasing use of improved maize seed and expanding national yields of maize. However, this is contentious, since it has been argued that increases in yields during the 1990s was achieved by expansion into new land rather than by increases in productivity. This suggests that increased yields in this 1990s were primarily achieved with farmers' own technology rather than uptake of SG 2000 sponsored inputs and seeds (Breth and Downswell 2003). A more critical technical perspective argues that SG 2000 was too commodity focused on maize and input packages, and was only sustained by providing favourable loans to farmers and the subsidisation of the transaction costs of input delivery systems. Thus, the programme collapsed when the elements of subsidy were removed (Breth and Downswell 2003; Dawson 2002; World Bank n.d.). An alternative socio-political critique, points to the political dimensions of the SG 2000 interventions, the high political profile of its leading figures and its access to large amounts of capital, but also to its links with commercial agribusiness, which enabled it to claim success while promoting controversial interests. Pupilampu (2003: 150) writes:

SG 2000 was able to play an important role in the NARS because its powerful leadership was able to gain access to the Ghanaian political elite and lobbied for resources to be devoted to extension education. But perhaps, SG 2000's alliance with multinational biotechnology firms at a time when the products of the biotechnology industry are the source of confusion, underscores some difficulties for the future of Ghana's agricultural research system, if it is to depend extensively on external support.

Although the SG 2000 programme no longer operates in Ghana, it has influenced subsequent developments within seed policy initiatives in Ghana, particularly in its focus on building linkages between government institutions and the private sector, and in providing support for private sector development in seed markets.

With the implementation of economic liberalism the main policies advocated by the World Bank and donors have included encouraging agribusiness investment in agriculture, the promotion of new export-oriented production, and the development of new horticultural crops. While interested in the potential of African markets, agribusiness has been reluctant to invest within the present business environments, and have created pressures on governments, donors and international financial institutions (IFIs) to introduce infrastructural investments and institutional restructurings, and to create a more favourable environment for investment. This includes state investment in transport and communication infrastructures, agricultural service delivery, land reform, seed regulation, in promoting quality control, and ability to comply with standards such as EUROGAP. Thus, organisations such as the Millennium Challenge Corporation (MCC), committed to pushing for agricultural development, do not only focus on the poorer districts in Ghana, but also on what has been termed the southern horticultural belt that lies in the immediate hinterland behind Accra, the zone producing export pineapples, mangoes and vegetables for European supermarkets in the hinterland of Accra. Demands that these crops conform to international standards to meet agribusiness requirements has resulted in a major refocus in agricultural programmes on certified seeds, inputs and standardised prescriptions. The need to regulate agriculture and improve standards has brought state institutions back into the picture, as major organisations involved in transforming agriculture through education, information and regulation.

In the 2000s funding for NGO programmes has diminished as donors have increasingly directed development funding through the Ministry of Finance. The aims of this have been to harmonise donor funding and objectives with national development priorities, and to achieve coherent multi-sector planning. Donors have also come together to harmonise their demands upon the state for policy transformation. As a result of this demands for policy change have become more focused and narrow and there is now less scope for pursuing a range of alternative programmes with donor funding.

The world food crisis of 2006-2008 has also created pressures that have been exploited by advocates of the African Green Revolution to reframe food security issues around an agenda of promoting domestic production to curtail growing expenditure on food imports. This involves promoting inputs, certified seed, better market integration and enforcement of standardised practices. This has enabled state agricultural services to be re-centred at the heart of the agricultural agenda, carrying out familiar routinised practices of promoting the uptake of new technologies and practices, and organising new 'smart subsidies' which partially subsidises the market to provide inputs to farmers at reduced costs. This enables a more harmonised agricultural policy to emerge as food and horticultural policies become united around a return to the Green Revolution precepts of improved seed, inputs and standardised logistical practices. Donors provide funding and technical support to bring this project to fruition. These do not only include national initiatives, but also regional and continental partnerships such as the Comprehensive Africa Agriculture Development Programme (CAADP) and the ACP-EU partnerships.

In Ghana the major external initiators in this process have been the International Fertilizer Development Center (IFDC), the MCC and AGRA. In 2002 the IFDC published 'An Action Plan for Developing Agricultural Input Markets in Ghana'. This report was sponsored by the Government of Ghana Ministry of Food and Agriculture (MOFA), and supported by SG 2000, USAID and the Ministry of Foreign Affairs of The Netherlands (DGIS). This report provides a framework for supporting the expansion of private sector initiatives in seed and fertiliser markets, and integrating the interventions of the state, NGOs and the private sector to facilitate the expansion of commercial input delivery systems.

In 2006, the Millennium Development Authority (MiDA) was inaugurated in Ghana to oversee the implementation of the Millennium Challenge Compact of the MCC in Ghana. The MCC provided Ghana with \$547 million for agricultural programmes in 23 districts in the Northern Region, the Afram Plains, and the horticultural belt of southern Ghana. The International Fertilizer Development Center (IFDC) is the major international implementing agency and it has been working to introduce a value chain approach to all stakeholders in the agricultural sector, which integrates farmers with agribusiness markets and supports the development of agricultural input dealers. MiDA works with the Agricultural Extension Services to train farmers and provides participating farmers with inputs, including both certified seed and fertilisers.

AGRA have also developed initiatives which support the development of commercial seed and input markets in Ghana, and promotes reform in seed laws. AGRA has supported the development of new commercial varieties in research centres in Ghana and is supporting the development of a West African regional plant breeding research centre at the University of Ghana with biotechnology capabilities. It also places high emphasis on hybrid seed development. It supports the development

of commercial seed companies in Ghana and of a network of agro-dealers. As with SG 2000, AGRA programmes are generating concerns over its relations with major seed and input agribusiness corporations, and the relevance of its approach to the needs of African smallholder farmers.

Agricultural policies have become more hegemonic and dominated by market agendas that seek to promote agribusiness interests within a reframing of the African Green Revolution. As a consequence, NGO activities concerned with exploring alternative visions of development to agricultural modernisation are increasingly marginalised, and NGOs interventions within the agricultural sector are refashioned around promoting agribusiness agendas, integrating farmers into markets and commercial agendas. However, as the space for alternatives agendas appears to become more confined and restricted, the dominant agenda has begun to crack under its own logic, as spaces are opened up for private sector actors. In recent years a number of new international actors have entered the African agricultural fray, with interests that do not conform to the close harmonisation of interests and integration of state, corporate sector and civil society around the commercialisation of smallholder agriculture. These include Chinese, Indian and South Korean business interests and new private foundations of US origin, including AGRA. An article entitled 'Agricultural aid: donors break rank' in the February 2010 issues of *Spore*² comments:

These days, funding for agriculture in ACP countries comes from a variety of sources. While donor countries and the major organisations are attempting to take a clear and common position on official development assistance (ODA), new players are muddying the waters, often showing scant interests in the rules set in place with such difficulty by traditional donors. The beneficiary countries find themselves torn between their agricultural policies, the regional agreements to which they have subscribed and the offers of the Chinese, the Indians or the major foundations, which are generally the easiest to approach... The government of [China]... makes no clear distinction between, aid, cooperation, private investment and trade. As well as state-owned enterprises, private companies are also moving into this sector, prompted to invest and work in these countries. The Chinese favour a pragmatic approach without bothering too much about development theories... The major American foundations are also independent players. Their stated objectives are similar to those of the Millennium Development Goals, but they maintain a strong degree of autonomy in the definition of their goals. They are prepared to deal with both governments and no-state actors: private companies, producer organisations and NGOs... [AGRA's] most pressing aim is to bring about a discernible increase in the output of the main food crops, through the use of more fertiliser and introduction of higher-yielding varieties, including genetically modified organisms

(GMOs). The Alliance is focusing the full force of its efforts in this area: training African plant breeders in Ghana and South Africa, carrying out research in the USA on nutritionally enriched GM crops, and creating a network of suppliers of inputs (seeds, pesticides, fertilisers) in Kenya, Malawi and Tanzania. The private foundations are also investing in national agricultural research institutes, for example in Burkina Faso and Mali. The money offered is hard to refuse, even though some of these foundations are linked to agri-chemical companies such as Monsanto and Syngenta. (CTA 2010)

While the Spore article contrasts the 'moral stand' of the 'traditional' donors with the new pragmatic agendas supporting 'obscure commercial agendas', these are very much value judgements, since pragmatism and the promotion of commercialism are very much key values espoused by the economic liberalism that has been supported and developed by the 'traditional' donors. These conflicting interests and value systems around new technologies and forms of commercial organisation do not only arise between new and old actors, but also between US and EU perspectives on GMO, which threaten to breakdown multilateral aid agreements. Thus, recent developments in the financing of development and the rise of new investors are likely to challenge existing market liberal paradigms and assumptions about market-based development, and open up debates about societal responsibilities in controlling the disintegrating effects of the accumulation of private capital.

While policy worlds are concerned with debates over theoretical frameworks and development paradigms, these are not central concerns in the world of development actors implementing policy directives. Here, the various platforms and networks energised by the framework of integrating state initiatives with civil society and the private sector, create complementary and competing roles and conflicts between those vying for access to resources in the implementation of the African Green Revolution.

4. The Green Revolution in Practice: Key Actors and Institutions

The institutional framework for the production of improved cereal varieties in Ghana is complex and dynamic. It involves a diverse network of policymakers, researchers, international development agencies, commercial sectors, financial intermediary organisations, NGOs, informal sector markets and socially differentiated farmers. The institutional frameworks that link these actors is rapidly changing. This results in many tensions within the networks, platforms and institutions, which result from the contradictions between a public system of research based on farmer participation and a private system of marketing, which negates the open exchange of knowledge built into the development of seeds and their evaluation by farmers, and attempts to own and transact these products (Kloppenborg 1988). The

contradictory framework of participatory breeding and commercial transactions seeds results in conflicting roles for various actors within the system of seed breeding and multiplication. This section examines these contradictions within the confines of current donor and policy initiatives in the commercial development of seeds in northern Ghana. It traces the various processes of transformation in the development of commercial seed and the perceptions of various actors involved in these processes. It firstly, examines the main institutions, actors and roles that emerge in the creation of certified commercial seed. This is followed by an analysis of the main perception of actors of their role in seed production and their perceptions of the process and of areas of conflicts with other actors. The third section investigates farmers' use of and perspectives on seed varieties.

4.1. The formal seed production system and networks in northern Ghana

The activities involved in creating certified seed in national centres move from adaptive research on genetic materials which gives rise to breeders seed, to the multiplication of these seeds and their transformation into uniform foundation seed, and then their further multiplication and conversion into certified seed, which is then produced by seed growers for sale to farmers. Within Ghana this process involves the movement of seed from government accredited research institutions, to government agencies involved in multiplication of seed, to private seed growers, and then to farmers or various intermediary organisations which distribute the seed to farmers. The intermediary organisations include NGOs, government projects, emergent commercial seed companies and commercial sector ago-dealers. At present, there are no commercial seed companies or any parastatal organisations that control the whole process of seed production. The existing multi-stakeholder structure has emerged as a result of a messy process of privatisation, which has disassembled government seed parastatals, but has not produced private sector investors who are willing to take responsibility for substantial parts of the chain of seed production. As a result of the failure to create viable commercial seed companies, a large number of disparate organisations have been engaged as partners in a process of developing the social, economic and knowledge infrastructure to facilitate the emergence of commercial seed delivery systems. This structure involves researchers, private sector producers of seed, private sector distributors of seeds and inputs, and a number of local and international NGOs creating training opportunities for organising commercial production, facilitating farmer uptake of new seeds, and linking farmers with agribusiness demand for certified seed and with input provisioning.

The production of improved varieties begins with the screening of genetic materials acquired from international and local sources in accredited research institutes. In northern Ghana this is undertaken by Savanna Agricultural Research Institute (SARI) and its satellite research stations in the Northern, Upper East and Upper

West regions. SARI is responsible for adaptive agricultural research in the conditions of the three northern regions.

Seed policy is defined by the National Seed Service, which comes under the Crop Services Directorate. The Director of Crop Services also chairs the Ghana Varietal Release Committee (GVRC), which sets criteria for evaluating varieties and tests individual varieties against these criteria. It develops criteria for further development, it accepts or rejects varieties that have been submitted for formal release, and delists released varieties that are no longer viable or desirable. Various expert advisors drawn from the agricultural services, research, and industry serve on the GVRC. The GVRC forms the main linkage between adaptive research carried out on research stations and national seed policy. Advisors shape seed policy by defining the national priorities and allocating funding to different crops. Cereal crops have gained relatively favourable priorities in funding, as compared to other crops, such as roots and tubers.

International agencies play a role in influencing seed development by working directly with seed breeders and crop institutes. These international agencies supply genetic materials for screening, provide training, and assist in information dissemination through regional networks, conferences, and workshops, and as well as funded research programmes. Such agencies include CGIAR centres with the mandates to develop specific crops such as WARDA, IRRI, CIMMYT, International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), and IITA, and networks, such as West African Seed Association (WASA). Other international institutions work within a number of levels within the seed system, shaping both technologies and institutional transformations. AGRA works directly with research institutions, to build new capacities, encourage programmes of hybrid development, build new biotechnology capabilities as in its support for new research facilities at the University of Ghana, and promoting the development of new seed laws in Ghana. Japan International Cooperation Agency (JICA) has been influential in sponsoring the Coalition on African Rice Development (CARD), which aims to double rice production in Africa through a number of interventions from facilitating information collection, the development of national strategies for rice production, to specific initiatives to rehabilitate irrigation projects.

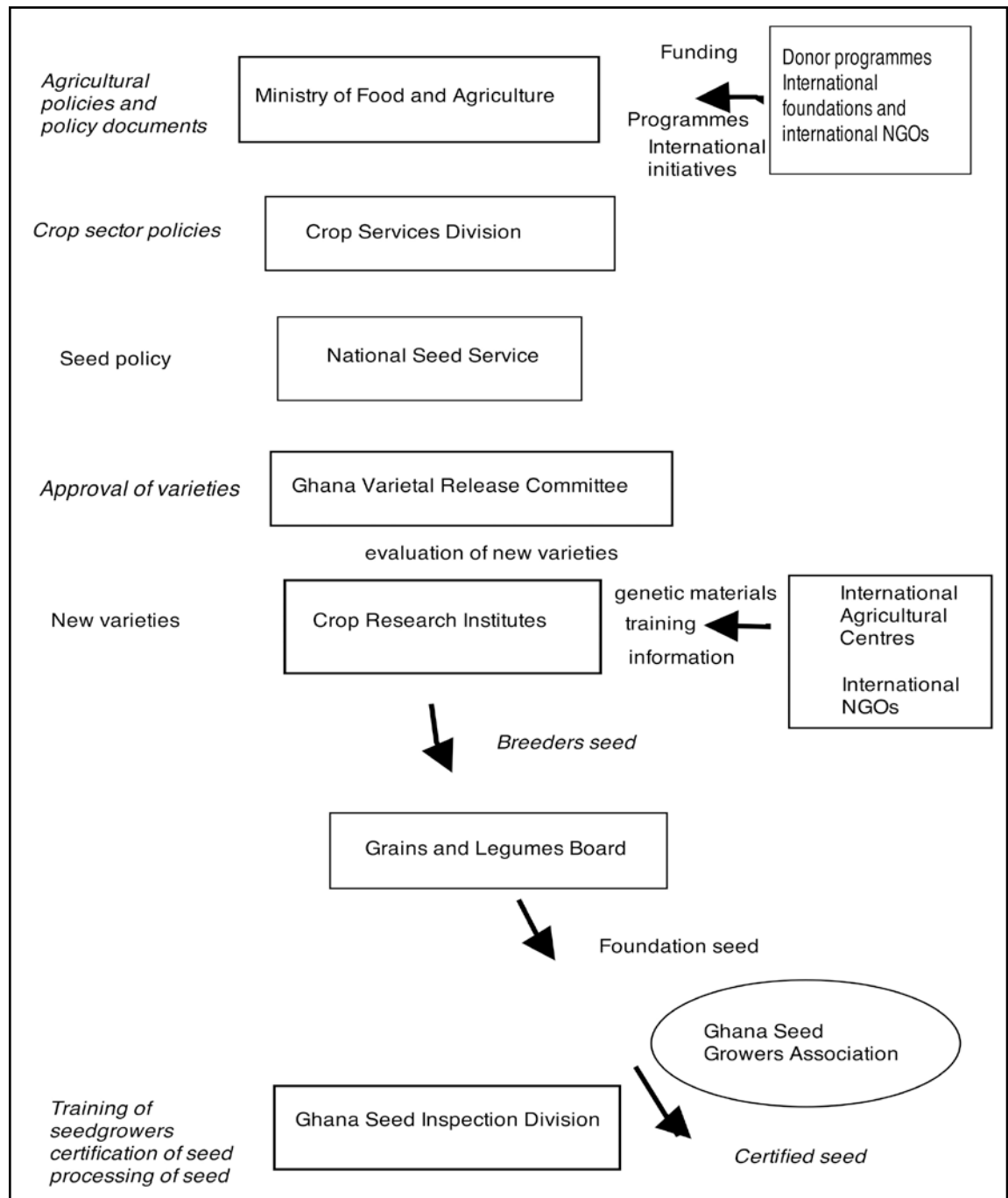
The process of decentralisation has also influenced certified seed production. Regional and district agricultural departments are responsible for developing regional and district priorities and planning processes. Since 1992, Research and Extension Linkage Committees (RELC) have been established at the regional levels. The RELC bring various stakeholders including researchers, extension agents, commercial agriculture, input dealers, NGOs and farmers to discuss and prioritise the main policy issues³. The RELC establish the main priorities for research and extension within the regions. While the RELC come under the Regional Directors of Crop Services they are often coordinated by researchers. The RELC are important to research, since areas identified as having high priority within regions stand good chances of attracting funding at the national level. Within the three

northern regions the RELC are coordinated by agronomists from SARI, and their recommendations contribute to the development of crop research programmes. The RELC also operate at the district levels, and representatives from district committees meet at the regional RELC to deliberate on agricultural policies and directives. The input of a wide spectrum of farmers into RELC deliberations is limited at the regional level, and it is likely that participating farmers tend to be drawn from those already linked into MOFA programmes - from the farmers most likely to embrace new seeds and input recommendations. This limitation becomes more pronounced at the regional than district level, since at the regional level a few handpicked farmers come to represent the interests of a large number of farmers, without any organisational structure of farmer representation or farmers' associations. The RELC also enable other stakeholders and programmes to influence agricultural programmes and research within the regions, and creates spaces and dynamics for policy change, outside the constraints of national policy directives. Thus, the RELC committees have formed an important avenue in which the agribusiness, NGOs, and the state sector come together to shape and work out the logistics for seed policies within specific regional contexts. Donors are also able to exert influence on the RELC through the regional programmes that they sponsor, which create forums for the development of commercial seed. Through RELC seed breeders are also subject to a number of influences within the regions, emanating from the dominant donor-driven programmes, commercial interests, programmes that are implemented by NGOs and intermediary financial agencies, the regional extension services, commercial interests and, to a certain degree, farmers.

Farmers are mainly able to influence seed development through participation in trials and the evaluation of new varieties. NGOs have often contracted plant breeders to participate in community or farmer group seed multiplication programmes, in which they provide farmers and projects with breeder seeds or foundation seed, and train farmers in seed multiplication techniques⁴. However, these programmes essentially work within the dominant precepts of researchers and the agricultural research system. They involve farmers learning from researchers how to produce seeds that conform to the standards imposed by the research system. Invariably this involves farmers multiplying certified varieties rather than providing them with the capacity to experiment on their own varieties of choice. Thus, participation, decentralisation and the blossoming of civil society tend to confirm and reaffirm the values of the research system, ensure that farmers conform to these values, and ramify existing power relations and routinised practice within bureaucratic and scientific institutions.

Since 1979, a significant number of cereal, rice, and sorghum varieties have been released by the research system. These have responded to increased yield, adaptations to specific agroecological environments, different maturing periods, resistance to diseases and pests, and cultural and culinary demands. Recent initiatives are

Figure 1. The official institutional framework of seed production in Ghana

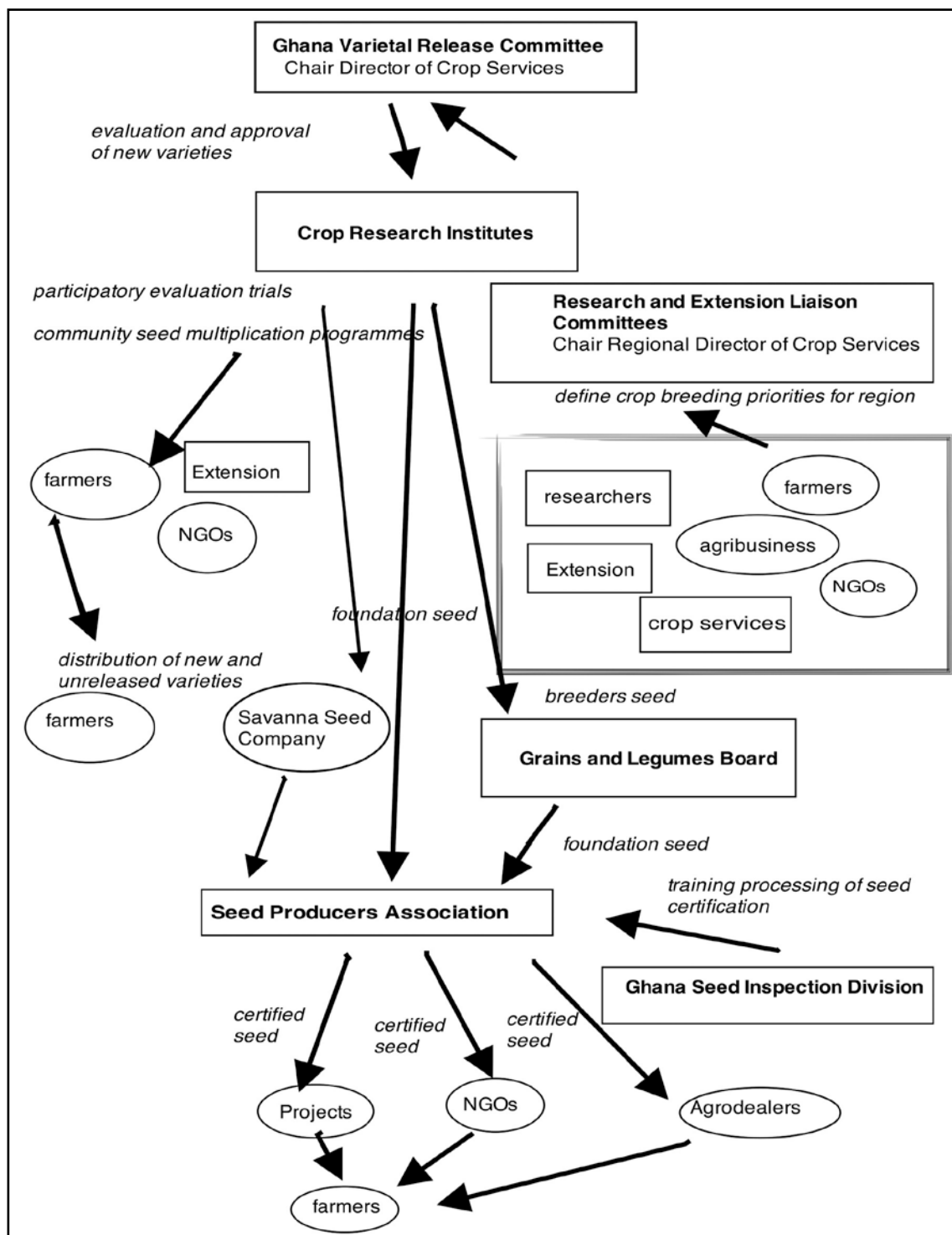


In reality the Ghana Grain and Legumes Board (GGLB) has little capacity to breed foundation seed and most of this is carried out by informal linkages with seed breeders, emergent seed companies and farmer groups. Since little of the seed used by farmers comes through this system, it is much more decentralised in practice.

concerned with breeding perfumed rice, rice adapted to upland conditions, Striga resistant maize and sorghum, drought resistant crops, and hybrid varieties of maize. However, many of the varieties have not had a long life, being rapidly phased out as problems have emerged with them, or as they have been replaced by new varieties⁵. The research system also has a limited capacity to maintain a diversity of pure breeders seed and old varieties are usually displaced and replaced by the most recent varieties.

Within the framework of official seed breeding, breeder seeds are transferred from research institutes to the Ghana Grains and Legumes Board (GGLB), which has the role of multiplying breeder seed into high quality standardised foundation seed. This role of the GGLB is enforced by existing seed legislation⁶. Kloppenburg (1988) has argued that the building of commercial seed breeding involved industry creating pressure for a division of labour in which public institutions were responsible for the basic and developmental science and the

Figure 2. Institutions, actors and the production of certified seed in Ghana at the regional level



The decline of Ghana Grain Legumes Board (GGLB) results in a decentralised system of seed production in which seed reaches farmers by many roots both through the Ghana Seed Inspection Division (GSID) and outside it through community groups, informal farmer networks, and participatory trials.

commercial sector for developing the end product and sending it to farmers.

In Ghana, with pressures to privatise seed production, this division took place at the level where foundation seed was converted into certified seed. Thus, the creation of Ghana Seed Company as a semi-parastatal company which would eventually be privatised, prepared for the commercialisation of seed by creating a clear division between the responsibilities of the public seed system

to produce foundation seed and the private seed industry to produce certified seed. However, in the terminal period of statism, the GGLB was left poorly resourced. As a consequence of this, the GGLB has been unable to meet its mandate of providing foundation seed. While its offices are often situated in impressive premises from a bygone era, the buildings are frequently dilapidated and empty. In the Northern Region many of the warehouses are now used to store emergency food aid for the north and the

staff are frequently absent. Informal networks of seed breeders and seasoned seed growers, including an emergent seed company, Savanna Seed Company (SSC) now fill the role of GGLB and produce most foundation seed. Some breeder seeds also go to community programmes run by NGOs, with seed breeders being contracted to instruct farmers on producing viable uniform seed from improved varieties for planting. Most foundation seed is now produced outside of the legal framework established in Ghana. The crop research institutes can, however, justify this with reference to Act 821, which empowers CSIR institutions to commercially market their research products.

In recent years, SSC has emerged as the most significant seed breeder organisation in the Northern Region and is one of three registered private-sector seed companies in Ghana. It has begun to play an important role in the creation of foundation seed in the Northern Region. SSC was established in 2008 by Joseph Bapule and Patrick Apula, two prominent seed growers in the Northern Region. Apula is currently the President of the Seed Producers Association of Ghana (SeedPAG). Bapule and Apula are both employees of SARI. Bapule is the Head of the Marketing Division and Apula the Estate Officer. Currently their offices are situated next to SARI. They have networks of contract growers in the Northern and Upper East regions who produce seed. They use SARI plant breeders to train these contract growers in the various processes involved in seed production and to monitor production. They then transport the seed for certification by the Ghana Seed Inspection Division, some of which also becomes foundation seed for other seed growers. Although, not trained as seed scientists or technicians, Bapule's and Apula's positions in SARI have given them access to specialised knowledge and networks on seed breeding. Some of the seed breeders at SARI are also registered seed growers and participate in the production of commercial seed, or work closely with SSC. The ambition of SSC is to establish a processing plant independent of GSID, and to develop hybrid seeds⁷. However, the activities of SSC have also been made possible by financial support from AGRA, in its bid to encourage commercial seed production in Ghana. Most of the demand for SSC seeds in Ghana does not come directly from farmers but from government and donor projects and NGOs, including MiDA, Opportunities Industrialisation Centre International (OICI), ACDEP, Technoserve, Sen Foundation, and ActionAid.

In the official version of seed production in Ghana (Figure 1), foundation seed produced by the GGLB should in theory be transferred to the Ghana Seed Company (GSC) for conversion into certified seed, which would then have been sold by farmers. However, in practice, political struggles over the shape and privatisation of GSC resulted in the removal of donor funding for its activities and this resulted in its liquidation in the late 1980s. As a consequence, the process of seed certification in Ghana has become fractured into two networks. The first comprises a state regulatory board, which has been reconstituted as the Ghana Seed Inspection Division (GSID) under the Plant Protection and Regulation

Services. The second consists of registered private seed growers, organised into an association. These include retrenched employees of GSC and seed growers who were originally contracted to produce for GSC. The GSID monitors, supervises and certifies seeds and registers seed growers. The seed growers are registered under the Seed Producers Association of Ghana (SeedPAG).

After harvest, potential certified seed is dried on farm before being transported to the processing plant of the GSID, where it is inspected for purity and viability, further dried, cleaned and graded. Processing of seeds is carried out at a nominal fee by the GSID. The certified seeds are usually stored in the warehouse of the GSID, from where they are sold by the seed growers. Few of the seed growers transport their seeds into the rural areas, and most of them depend upon NGOs, government projects, and to a limited extent ago-dealers to purchase their seed. Frequently, contracts for seed supplies are passed through the GSID. Thus, production of commercial seed does not depend upon market demand from farmers, but on intermediary organisations that are promoting the uptake of commercial seed. In recent years the most significant demand for seeds has come from Millennium Development Authority (MiDA), which provides subsidised packages of certified seed and fertilisers to farmers, with the subsidy being passed on to commercial ago-dealers. Nevertheless, seed growers complained of widely fluctuating grain markets, in which it is difficult to predict the demand.⁸

In the northern Region there are currently 51 registered seed growers. Certified rice is produced by 48 growers, 38 produce certified maize and only 2 produce sorghum, including SSC, which had been contracted to supply certified sorghum for the breweries⁹. Most of the seed growers concentrate on a very narrow range of varieties. The rice growers mainly focus on four varieties, Afife (GR 18) Tox 31-07, Jasmin 85 and Faro 15. Among the maize seed producers, 39 produced Obatampa, 2 Okumasa, 1 Dodze and 1 Doke in 2009. None of the seed growers are producing any of the recently released hybrid varieties.

Ago-dealers retail most of the certified seeds sold on the open market. The ago-dealers usually have small retail shops and kiosks established in the main market towns.¹⁰ The ago-dealers mainly focus on the sale of synthetic fertilisers and agrochemicals. Certified seed is a low priority commodity transacted by ago-dealers, since there is little direct demand from farmers. Most of the demand for certified seed originates from donor-funded projects and NGOs. These demands for seed often come in large contracts. As a result, registered seed growers in the Northern Region cannot always meet the demand for certified seed, and ago-dealers often purchased seeds from other areas. Ganoma purchases additional maize seeds from Techiman, and Kayoma and Wumpini from Kumasi.¹¹ The ago-dealers only sell one variety of seed directly to farmers, Obatampa maize. There is little demand for certified rice and sorghum. Other varieties, disseminated to farmers and projects, such as sorghum for the brewing industries, are supplied from sources other than Northern Region ago-dealers

and seed growers. AGRA, IFDC and the MiDA have supported the development of the Ghana Agrodealer Development Project (GADD), which seeks to bring agro-dealers and seed producers together in Ghana to support the delivery of certified seeds and inputs to farmers. The main activities of GADD involve:

- Building agrodealer capacities through training in creating business linkages with input and seed suppliers, and helping them to extend their networks into rural areas through village-based agents;
- Organising ago-dealers into trade associations, and supporting the development of an Agricultural Association Business and Information Centre to serve members and lobby government for their interests;
- Facilitating access of ago-dealers to finance;
- Introducing ago-dealers to 'transfer of technology techniques' to enable them to carry out field demonstrations to promote best agricultural practices¹².

In contrast with ago-dealers, the major fertiliser distributors are large companies, often with international private investments portfolios. The largest company, Wienco, supplies about 48 percent of fertilisers imported into Ghana. The main fertiliser importers work through wholesale outlets as well as distributing directly to end-users including the most significant agribusiness and agroindustrial concerns in Ghana, such as oil palm, tobacco, cotton and irrigation projects (IFDC, 2003). The large fertiliser companies also have considerable influence on policy. During the 2008 world fuel crisis (which led to hikes in fertiliser prices), the main fertiliser importers in Ghana approached government to introduce a subsidy to ensure that farmers could still afford to purchase fertilisers. MOFA drew up a programme for widespread fertiliser distribution organised within a voucher scheme. However, many of the ago-dealers protested that the scheme undermined their business. Subsequently, programmes such as MiDA have attempted to involve ago-dealers in the distribution of inputs, with support from AGRA, IFDC, and other agencies. SSC is also involved in training of ago-dealers within GADD to expand their operations into the rural setting, facilitating the further distribution of commercial seeds to farmers.

The large fertiliser companies also work directly with government to supply projects with inputs and benefit from the expansion in interest in promoting new Green Revolution approaches. Wienco has also expanded its agribusiness interests, and is involved in the development of both export Mango in the Northern Region and in establishing Masara N'Arziki, a farmers' association which promotes organised farmer that receive input packages in the form of fertilisers, certified seed, herbicides, spraying equipment and farm implements, training and technical advice and access to affordable credit. Masara N'Arziki organises contract farmers to supply industrial maize and sorghum to the breweries, livestock industry, and other institutions. Masara N'Arziki is supported by a large number of input suppliers whose products are sold to participating farmers on credit¹³.

A number of NGOs have initiated programmes that build linkages between farmers groups, agribusiness, and financial intermediary services. Technoserve¹⁴ has

organised training for farmer groups to produce cereals for business corporations, and has attempted to identify suitable varieties of cereals for use in the brewing industry, infant food production and for poultry feed. In the northern regions Association of Church Development Projects (ACDEP) has also established Savanna Farmers Marketing Company Ltd (SFMC), a private limited company that links farmers with agribusiness and provides loans for farmers to use certified seed and inputs to produce standardised quality grain for industries. Other projects linking farmers with national food processing companies include the USAID sponsored Agricultural Development and Value Chain Enhancement (ADVANCE) Project implemented by ACDI/VOCA. Increasingly, NGOs are working within a conceptual framework of developing value chains and food governance, and promoting the development of improved seeds within this framework of commercialisation. These activities have often grown out of community seed banks, which sought to facilitate the storage of gains after harvest first as a food security response, and then to enable famers to gain better prices by storing grain until grain prices rose. However, as more farmers and traders began to store grain and as banks provided loans to traders for grain storage and marketing, the price gains in community grain storage have declined (Dawson 2002). In an effort to upgrade prices received for grains, NGOs have attempted to improve the quality of grain through introducing grain multiplication programmes and through linking farmers to food industries willing to pay premium prices for quality grain. In Ghana this focuses mainly on the brewery and infant food producing (mainly Nestle Ghana) industries. This has also enabled NGOs such as ACDEP to gain new sources of funding as agricultural policy changes.

The framework for the delivery of improved seed has evolved into a complex network of agents involved in the creation and distribution of seeds and inputs; extension, training, organisation and social entrepreneurship; provision of financial services; agribusiness contracts; and regulation, monitoring and evaluation. This partly results from the failure of structural adjustment to initiate the successful privatisation of agricultural seed services. As a result, what has emerged is a structure of networks, contracts and partnerships between various organisations working together to facilitate the types of institutional reform that will facilitate the emergence of private markets in inputs and seeds, and working to simulate a demand for new varieties and standardised seed that will encourage farmers to move into Green Revolution technologies. These networks promote the development of markets in seeds and subscribe to the principles of free market development. However, the interventions that are made are essentially politically motivated. They attempt to integrate farmers into politically pre-defined markets that have essentially been created through donor-funded. They do not attempt to create open spaces for markets to evolve 'naturally' in which, for instance, markets for the factors of production would conform to farmers demand and enable farmers to exercise choice. In place of this, farmers are being encouraged

to conform to the dictates of agribusiness interests to promote Green Revolution technologies. These interventions are justified by unproven assertions and assumptions that existing certified seed and use of inputs can solve farmers' problems and food insecurity in Africa, and transform agricultural production.

In Ghana, few farmers purchase certified seed. Within the GSID it is openly acknowledged that less than 10 percent of farmers purchase improved seed. However, most of the improved seeds reach farmers through projects involved in promoting seed and fertiliser as a package and in stimulating an artificial demand in seed.

At every stage of the delivery of seeds, from research centres to farmers, political interventions have been made that seek to push the evolution of seed policy towards commercial development. By funding particular sectors, while starving other sectors of funding, a commercial agenda can be gradually pushed by both donors and governments. Within the present era, the government actively supports the development of private commercial agricultural services and promotes an agribusiness agenda.

In the structural adjustment period donors were able to promote the commercialisation of seed by actively supporting and financing the development of GSC, while allowing the GGLB to be starved of resources. This effectively created a division between the public sector of breeding, concerned with breeder seed, and the private sector of certified seed, which could be sold on the market. When government resisted the privatisation of the GSC, withdrawal of donor funding for this organisation caused it to collapse. This effectively transformed certified seed into the realm of private seed growers who depended upon sale of seeds for their livelihood. By funding SSC, while GGLB continues to be neglected and fails to produce foundation seed, AGRA creates the conditions for the emergence of large commercial private seed companies within a new structure of production, in which foundation seed production and certified seed can be integrated as a commercial venture, promoting further commercial control over seed production. Although the commercial seed sector is dependent upon viable public sector development of seed, the public sector can also be influenced through the strategic placement of funding. Thus, AGRA funding for hybrid seed programmes within public research centres shapes a public agenda that conforms to and favours the privatisation and ownership of certified seed.

Support for agrodealer networks and 'smart' market subsidies (that reduce prices of seeds and input packages that are absorbed by government and donors and distributed by projects) effectively stimulate demand for agrodealers and seed producers. However, they do not allow farmers to determine which bits of packages they require. Although they do not hamper private sector initiatives, they no less distort demand for agricultural products than government service subsidisation in the pre-structural adjustment era. They lock farmers into commodity markets without allowing them to exercise choice, beyond refusing to participate in the development programmes. Similarly, projects that link farmers into

agribusiness markets and provide assured markets for crops produced with certified seeds and inputs, also serve to tie farmers into political structures that enforce uptake of new technologies. Although markets can be politically constructed, uptake under these conditions does not result in the efficacy of promoted technologies, and unforeseen and unintended outcomes can act to destabilise and unravel civil society networks and lead to recriminations.

4.2. Constraints, conflicts of interest and conflicting interests in the formal seed production system

Donors, governments, NGOs and agribusiness have created programmes that mobilise farmers to use certified seed. These projects intend to replace the existing seeds and practices that farmers use with certified commercial seed and inputs acquired from registered seed breeders and agro-dealers. Donors have expended large amounts of funding on creating linkages to facilitate institutional change to support these developments. However, the uptake of seeds is ultimately dependent upon the performance of seeds within farmers' fields. It is at this juncture that all the claims about improved certified seed begin to crumble. While the new Green Revolution programmes have been able to deliver seeds and inputs to farmers and assure them stable markets for the products, they have not been able to guarantee that certified seeds will perform.

Sorghum and maize seeds distributed to farmers groups as certified seed have in many instances failed to germinate and have resulted in disappointing yields. Unable to gain reliable sources of seed from certified growers approved by the GSID, NGOs working with community groups to meet demands from agribusiness have turned to seed breeders to establish community seed breeding programmes. The seed breeders work with community groups in multiplying high quality breeder seed into uniform seeds for planting, which will meet the requirements of industry for standardised and uniform seeds. This has exacerbated tensions between the two ends of seed breeding – firstly that concerned with participatory trials with farmers to fine tune varieties to farmers needs, and secondly with the multiplication and commercialisation of seed. NGOs promoting the use of certified sorghum seed by farmers have run into problems of acquiring quantities of reliable seed. Much of the certified sorghum failed to germinate. In response to this situation, ACDEP began to work with certified breeders to provide quantities of breeder seed to farmers and to instruct community groups in techniques of multiplying, drying and processing seeds to ensure pure quality seeds¹⁵. This has resulted in accusations by seed growers and the GSID that seed breeders and NGOs are undermining and circumventing the regulatory processes of seed breeding¹⁶.

In response, seed breeders complain that the certified seed of seed growers is frequently of poor quality. One breeder alleged that a major problem in the creation of certified seed is derived from the fact that the inspectors within the GSID division are also seed growers in their

own right, as are other employees of MOFA. As a result of this there are sometimes pressures on them to certify sub-standard seed. Dr J.M. Kumbiok, a plant breeder at SARI who has been working with ACDEP, explained that it was necessary for researchers to work with farmers in establishing participatory evaluation to adapt new varieties¹⁷. Some of these varieties come from IITA. However, researchers cannot obtain these varieties in sufficient quantities, so they need to multiply them. However, they do not have sufficient logistical support within the research institutes to multiply seeds in sufficient quantities for participatory trials. Therefore, they have been working with farmers to multiply seeds through organised farmer groups. These methodologies have also been used to help farmers in deep rural areas acquire new seeds, since commercial seed dealers do not reach these areas. Seed breeders have been working with ACDEP to help farmers gain greater accessibility to seeds. But, the seed growers are not happy with this arrangement, particularly if the seeds are of better quality, since they feel it is a threat to their business. As a consequence of these disputes, seed breeders and seed growers within the region are now trying to find solutions that will integrate community seed production with the commercialisation of seed.

The blame game emerges from the fluidity of seed production as various parties vie for roles in the new emerging system or feel threatened that they will lose out. Blaming other actors also enables narratives about the superiority of improved seeds to remain intact, by suggesting that the problems lie solely with the actors rather than the technologies and the policies. But the characteristics of the new varieties also have their limitations. The new variety of improved sorghum, Kapala, which was recommended for farmers to cultivate for the brewing industry, has problems with compact heads. It could only be successfully cultivated in the drier conditions of the Upper East and West Regions. In the wetter conditions of the Northern Region it is prone to mould infections. The compact heads are also vulnerable to predation by birds, resulting in unsatisfactory yields. In

contrast with boasts of the capacity of the African Green Revolution to produce new seeds that outperform farmers' own varieties under existing farm conditions, the performance in reality has been disappointing. The certified seed supplied to farmers has been of poor quality and the varieties have performed poorly in farmers' fields. With the failure of sorghum seeds to perform, ACDEP has now acquired varieties from Nigeria for farmers to multiply in community seed programmes. Despite these failures, the rhetoric of the Green Revolution continues unabated, reaffirming the superiority of certified seed and the need for this to reach farmers through expanding networks of agro-dealers carrying market based solutions of new technology. Thus these narratives serve as a politicised rallying call to mobilise the civil society-private-public sector networks that have been constituted to bring about agricultural transformation. However, in the process policy loses the ability to be reflexive.

Actors within particular institutions performing similar roles do not hold uniform perceptions on seeds. Seed breeders within SARI hold different perceptions on seeds. Some seed breeders are deeply interested in the commercialisation of seeds and development of hybrids, while others hold more ambivalent positions. For instance, Dr I.D.K. Atokple¹⁸, a sorghum breeder at SARI, is convinced that hybrid seed development forms the most promising line of development, since it prevents farmers successfully multiplying seeds and gaining access to the intellectual property rights of breeders for free. He believes this will stabilise seed markets and facilitate the commercial development of seeds. He believes that hybrid seed development will facilitate greater control over seeds and purer lines. Dr Atokple openly acknowledges that he is also a seed grower producing certified seed. In contrast with this position, Dr Roger Kanton¹⁹, a SARI plant breeder based at the Manga station in the Upper East Region is more sceptical about hybrid seeds. He is unconvinced about the evidence that hybrids outperform open pollinated varieties. At the present level of development of seed breeding in Ghana he believes that

Table 1. Use of inputs

Inputs and Services	Dundo	Kpalung	Total
Synthetic fertiliser	98	74	85
Tractor Ploughing	98	100	99
Practice Bush-fallowing	2	39	17
No of farmers	41	46	87

Table 2. Source of Seed

Source of seed	Dundo (%)	Kpalung (%)	Total (%)
Own seed	81	89	85
Purchased	5	7	6
Multiplied small quantities of purchased seed	10	4	7
Only buy if don't have sufficient	2		1
SARI	2		1
No of farmers	41	46	87

hybrids are costly, time-consuming and probably not cost-effective, since new varieties do not have a long life and are continually being replaced to address the shortcomings of existing released varieties. He also argues that farmers who cannot afford hybrid varieties will be prevented from gaining access to new varieties. While this represents extremely important reflections on the paradoxes and problems of seed breeding and seed commodification in Ghana, these are private reflections that are rarely articulated in policy narratives and debates, which in the contemporary world tends to be rhetorical devices to drive policy hegemonically.

Table 3. Rice Varieties grown by farmers

Rice	Dundo (%)	Kpalung (%)	Total (5)
Tox 13-07*	2	67	37
Mandee*	15	24	20
Aberekukwa	39	0	18
Kpokpila	11	0	15
Afife (GR 18)*	22	4	13
GR 19*	20	0	9
Anyifola	2	4	3
Nerica*	5	2	3
Sinkapirele	5	0	2
Digan*	2		1
No of farmers	41	46	87

* Nationally released varieties

Table 4. Maize varieties grown by farmers

Maize variety	Dundo (%)	Kpalung (%)	Total (%)
Yellow maize	93	31	60
White maize	98	17	55
Okumasa*	2	80	44
Obatampa*	0	39	21
Kawanzie*	2	2	2
No of farmers	41	46	87

* Nationally released varieties

Table 5. Sorghum varieties grown by farmers

Sorghum variety	Dundo (%)	Kpalung (%)	Total (%)
Beriko	2	54	30
Kulnyaviilna	44	2	22
Kwakwabura	24	11	17
Mankariga	9		5
Warizu	2		1
No of farmers	41	46	87

All local varieties

A further tension in seed production and delivery chains emerges from the use of participatory trials and testing by farmers. Much of the success in plant breeding during the 1980s has originated from the adoption of farming systems research and from involving farmers in the evaluation and development of new materials. This has entailed the distribution of new unreleased varieties to farmers for testing. Farmers rapidly multiply these varieties and distribute them among their social networks, with the consequences that new varieties are widely cultivated by farmers before they are officially released. However, this exchange of knowledge is predicated on a learning process based on the free exchange of genetic materials and open access, rather than on property rights and commodification.

4.3. Farmers and the informal seed production system in northern Ghana

Farmers adapt to different environments and circumstances. As a result of this there are different gradations of integration into crop and input markets, use of inputs, and farming systems. Around the Tamale metropolis high demand for both land and residential purposes results in land scarcity, movement towards permanent cropping systems, and use of fertilisation including synthetic fertilisers, manure and night soil. Cropping largely focuses on production of grain for sale on the urban market. In more distant areas away from the urban centres in the Northern Region, population densities are low, farmers practice extensive long bush fallowing systems, and cropping is more diversified with more focus on yams. For the purposes of this study, a survey was carried out on farmers in two communities, Dundo and Kpalung, both in close proximity to the Tamale urban market and with easy access to input delivery services. Both settlements focus on the cultivation of maize and rice for the market, supplemented with cowpea, groundnuts and sorghum. The objective of research was to investigate farmers' use of inputs under optimal conditions, since they had easy access to input suppliers and were able to exercise a conscious choice about their use.

Dundo is situated in the immediate vicinity of Nyankpala. It constitutes a peri-urban area in which modern rectangular concrete residential buildings of urban dwellers are beginning to encroach on the circular thatched village architecture. Land is scarce and most farmers engage in permanent cultivation and maintain soil fertility through use of inputs. In contrast with this, Kpalung is situated behind the Savelugu market. There is no urban overspill into this area. Land is not in short supply, and around 40 percent of farmers continue to use fallows. In both settlements farmers are largely producing cereal crops for markets, and have both intensified their production and use of inputs. In both settlements farmers choose to invest their capital in the purchase of fertilisers, use of tractor services and hire of labour rather than in improved seed (see table 1). Ninety eight percent of farmers at Dundo use synthetic fertilisers, as compared to 74 percent at Kpalung. However, only 6 percent of farmers in both settlements purchased commercial certified seed for planting, and 85 percent

of farmers in the survey relied on their own stock of saved seed for planting. Seven percent, including 10 percent at Dundo (which has ready access to seeds since it is situated close to Nyanpala) and 4 percent of farmers at Kpalung purchased small quantities of improved seed and then multiplied them on their farm (see table 2).

Although use of certified seed is low, farmers are not locked into cultivating their own traditional varieties, but use a wide range of seeds including improved varieties, which they multiply and exchange with other farmers. Large numbers of farmers use improved varieties. The most commonly planted rice varieties in the two villages include Tox 13-07 (also known as Sikamu,) Mandee, and GR 18, which are all nationally released varieties (see table 3). At Nyankpala Rice Mills, the most common varieties brought in for milling included the improved varieties GR 18, Jasmin 85, Digan, Tox 13-07, Nerica 1, Nerica 2, Nerica 14, Mandee, Faro 15 and the local variety Kpokpila²⁰. Nerica 14 was not yet formally released, but a few farmers had already begun cultivating it. Nationally released varieties have not wholly displaced local varieties, but complement them. Local varieties continue to be grown by significant numbers of farmers.

Okumasa and Obatampa are the most common varieties of certified maize planted that were identified by farmers (see table 4). However, there is considerable intermixing between maize varieties, and many farmers cannot clearly distinguish the varieties on their farms. Many of them only distinguish between white and yellow maize. This is also a problem that characterises certified seed. One seed breeder commented that it was difficult to find any pure stand of Obatampa maize within the Northern Region, including on the farms of seed growers.

Sorghum varieties have been displaced by maize in recent years in the Northern Region. Sorghum is often intercropped with maize, to ensure some yield if rains fail, or planted on drier areas of the farm. Farmers continue to use their own local varieties of sorghum, which they prefer to the newly developed released varieties (see table 5).

On the retail markets in Tamale, grain traders differentiate only between white and yellow maize and red and white sorghum, while rice sellers, on the other hand differentiate between individual varieties. Some of these rice varieties are associated with particular culinary qualities. For instance, Mariah Sulemana, a rice trader, narrated: 'I sell Anyifola, Mandee and Gomma [from Bolgatanga] varieties. Some people like Anyifola very much. Especially those people who prepare Wakye [rice and beans]'. Samata Ibrahim commented: 'Most people buy Mandee more than others. Mandee is preferred because it expands when cooked. Just a little and you can feed your family'. Hamdia Muntari also stressed the same qualities of Mandee: 'Tox is very sweet [delicious] when cooked but does not expand. Mandee is not as sweet as Tox but it expands more'²¹.

In addition to market demand and culinary qualities farmers also select varieties on the basis of their adaptation to particular farm environments. Farmers are often keen to experiment with new varieties and try them out

in different farm localities. As one farmer at Kpalung explained:

Whenever we gain access to a new variety, we test it in various places on the farm to see where it will do well. If it is promising it gets distributed widely. Anyone wanting some will come and exchange a bowl of seed from their own crop for a bowl of the new variety, and then multiply them on their farms.

Through this process new varieties that come to farmers by way of participatory trials are rapidly disseminated through farmer seed exchange networks, resulting in the situation in which unreleased varieties can rapidly gain currency among farmers.

In addition to being the advanced multipliers of the latest varieties, farmers are also the custodians of the varieties released by the formal research establishment. All certified open-pollinated varieties that become popular among farmers are essentially transformed since the process of 'contamination' of seeds by farmers multiplication also constitutes a process of local adaptation. This is recognised by both farmers and the formal system of plant breeding and multiplication. Thus, the Chief Inspector of the Regional Seed Division classified Faro 15 as 'almost a local variety', which was on the brink of being officially phased out although it was still 'admired' by the local farmers. Some farmers also classify some officially released varieties as local varieties, such as Mandee. They justify this by arguing that once a variety is popular among farmers it becomes 'local'.

Farmers tend to cultivate a wider range of varieties than are available within the official system of plant breeding. The official system has a limited capacity to maintain the purity of a wide range of varieties, and new released varieties tend to replace older varieties, which become delisted. Seed growers also tend to cultivate a very limited range of varieties which they can most easily sell and which are easy to multiply. However, since they mainly rely on projects and government services to purchase their seeds, these are often the varieties given official sanction than those that are most in demand among farmers. In the Northern Region the varieties of rice cultivated by seed growers in 2009 included Tox 31-07, GR 18, Jasmin 85 and Faro 15²². While new Nerica varieties could be obtained from grain traders, no seed growers were multiplying them. Similarly, no seed growers had taken up cultivation of new hybrid maize varieties although these had officially been released. Only two seed growers, including SSC, were cultivating new sorghum varieties, and this was in response to the demands from agribusiness projects. It can be argued that far from being on the cutting edge of innovation and seeds, the existing seed growers tend to respond to existing demand and play safe. In contrast, experimentation by farmers in the context of their participation in seed trials and their rapid independent dissemination and experimentation with new varieties on their own farms constitutes the more innovative aspect of seed development.

Sadly, the important roles that farmers play in developing and maintaining varieties are not recognised in

the official world of seed policy. The formal seed system constructs farmers as passive recipients and end-users of certified seeds, and victims of their own poor quality seed that entrenches them in poverty. In reality, farmers are capable innovators and actively involved in the multiplication of seed.

5. Conclusion

The cereal seed system in Ghana was initially constructed from the 1950s on the basis of a set of discourses and discursive practices associated with agricultural modernisation, emanating from developments in the USA. This was based on establishing experimental stations, and research to identify high-yielding varieties and cultural practices to raise production through the use of synthetic inputs. This was embedded in a system of public state sponsored research and collaborative research with international agricultural research centres. By the early 1960s this resulted in the concept of a Green Revolution. While new varieties and technologies were rapidly adopted in the irrigated environments of Asia, it was difficult to adapt these Green Revolution technologies to the complex, diverse and erratic climatic conditions of Ghanaian conditions. By the mid 1970s, a new approach had been worked out with an emphasis on smallholder farmers and farmer participation in evaluating and fine-tuning new varieties. However, the beginnings of a viable strategy for agricultural development coincided with the economic crisis of the 1970s and the pressures of the state to divest agricultural services to private capital. This resulted in a set of new narratives about agricultural development that blamed the shortcomings on lack of private sector development, bureaucratic mismanagement, and distortion of agricultural policies by statist policies. But under liberal market reforms private investment in the seed sector was not forthcoming. Consequently, the seed system was fractured into a poorly funded state research sector and a large number of private small seed growers with no finances to develop viable private sector companies.

As a response to these constraints, donors have supported the development of complex networks of state actors, NGOs, and various private sector operators, working to establish a favourable social, economic and knowledge-based environment for the emergence of commercial seed markets within agribusiness value chains. In the course of promoting the commercial development of seeds, policymakers have assumed that the main constraints in seed development problems result from the lack of commercial markets and not from technological constraints within plant breeding. As a result of this, Green Revolution approaches, supported by powerful business interests, are once again resurgent and reorganizing the seed sector in Ghana. However, in their bid to lock farmers into the purchase of commercial seed, the assumptions that inform the narratives through which seed networks mobilise support for policy interventions are in danger of eroding the participatory foundation on which plant breeding and development have been constructed.

The complex civil society networks that are empowered to act in the name of seed development are organised around simple narratives that define the interests of the various actors in the network and their position in relation to the other actors (Keeley and Scoones 2003; Hajer 1995). This begins with Malthusian narratives of population increase and the need to increase agricultural productivity to meet food needs. This is further elaborated along story lines developed by the International Fertilizer Development Center (IFDC) to justify technical interventions based on introducing seeds and fertilisers, which equate adoption of seeds and inputs with increased food production and rising productivity.

Onto this is woven a second set of narratives associated with the Millennium Villages Project concerned with a looming food crisis, and the need to increase government investment in agriculture and support for the development of high input commercial agriculture rather than reliance on food aid. This set of narratives empowers government to intervene in supporting the extension of new technologies to farmers, and investing in creating an enabling environment for commercial agriculture. This enables government to act, once more, as a powerful actor in agricultural development, albeit in synergy with private sector input delivery systems.

The third sets of narrative are concerned with supply chains and private sector led developments that create new investment opportunities for farmers, facilitate poverty alleviation, and create 'markets that work for the poor'. These sets of narratives are concerned with empowering agribusiness contractual linkages, inter-professional bodies that lobby for commercial interests, financial intermediary organisations, and input suppliers as actors working on behalf of promoting agricultural development. With declining sources of funding for radical alternative approaches to agricultural development NGOs are increasingly co-opted and contracted into these networks to organise farmers and lock them into agricultural commodity and input markets. These narratives equate successful seed delivery systems with privatisation, but have further evolved to take cognisance of public-private partnerships and the demands of agribusiness for food chain governance and quality and logistic control.

These narratives work together to justify a particular set of interventions geared towards promoting considerable investment in the development of commercial markets and agribusiness production. While these discourses facilitate a set of specific interventions in the commercialisation of seed, they block out a number of other discourses on seeds. Most notably, concerns about the impact of the commercialisation of seeds on genetic diversity and the rights of farmers to maintain their own varieties and decide on their own futures are completely marginalized. Discourses about the development of commercial seeds and food value chains are premised upon a number of assumptions.

Firstly, they assume that liberalised markets are pro-poor and that farmers are empowered by becoming organised to participate in agribusiness food chains as recipients of new technology. This blocks out approaches

that see empowerment as originating from the ability to exercise choice. However, there is little evidence that the privatisation of seed production in Africa has resulted in significantly improved seeds better tailored to farmers' needs (Zerbe 2001).

Secondly, the discourses assume that existing improved varieties are unproblematic and provide the solution to farmers' problems. The lack of adoption of improved varieties is assumed to be the result of the ignorance of farmers, and farmers can be educated to adopt these varieties through demonstration, provisions of credit, and through subsidisation of the high costs that result from imperfect markets. Considerable resources are being devoted to creating institutional frameworks to cajole farmers into adopting certified varieties, and to create a demand for certified varieties through interventions from above, rather than through farmers exercising choice in the market. The pitfalls of this approach are illustrated by the ill-fated use of certified sorghum seed for the brewing industries in northern Ghana.

The third set of assumptions presumes that farmers do not have valid varieties of their own, valid traditions of experimentation, or valid knowledge of varieties. Farmers have in many respects made important contributions to existing seed research systems, and the success of these systems has in part been built upon participatory methodologies that have enabled them to contribute towards the selection and adaptation of new varieties. Farmer participation in adaptive research has been premised on their access to new genetic materials, which they have also experimented with and distributed through their own independent networks. While farmers have often been reluctant to purchase improved seed, they have not been averse to adopting new varieties, and incorporating them into a pantheon of their own preserved varieties - those that have already been adapted to different conditions on the farm. Any attempt to develop commercial channels for seeds that undermines farmers' open access to new varieties and experimental varieties may ultimately have adverse effects on participatory adaptive trials and on the qualities of future seed.

Fourthly, assumptions are made that subsidised input supply programmes will not distort production and markets and can easily be targeted to farmers' needs. Contemporary policy frameworks are at pains to make sure that input support for smallholder farmers do not distort input markets and undermine the development of commercial input supplies. However, they fail to examine the impact of the subsidisation of inputs and the transaction costs of input delivery systems on farmers' own production systems. Subsidised commercial inputs may distort the cost of production, favouring use of inputs when other strategies may be more rational given the true market cost of inputs. This is particularly the case in sectors where low input usage is able to compete effectively against imports, as occurs with maize. Failure to examine the ways in which farmers rationalise their farm production and use of inputs and other factors of production can lead to the distortion of existing

conditions. Policies that favour the subsidisation of commercial agro-dealers can distort agricultural markets, just as happened in the 1970s when policies favoured the subsidisation of commercial farmers at the expense of smallholders. Similar assumptions were made by the SG 2000 programme, which subsidised the transaction costs of input delivery systems to promote demand for inputs and commercial seed. When the subsidies were removed, loan repayments by farmers collapsed.

Finally, assumptions are made that the success of plant breeding strategies and development can be directly measured in terms of the productivity gains in the yield of experimental plots and in rising national production. This is problematic, in that gains in yields can also result from increasing investment in labour and weeding. While there have been some production gains in Ghana which have been attributed to increasing use of inputs and seeds, there is no empirical evidence for drawing this conclusion and excluding the possibility that this results from increasing investment in labour. This discourse also prevents reflection on the large number of failures of state sector and private sector initiatives that have attempted to promote certified seed and inputs usage over the last half century. The reality is likely to be more complex, characterised by a set of mixed fortunes in different agricultural sectors and areas, in which some farmers gain through use of inputs, and others expand production successfully through investment in labour. These differing conditions and experiences need to be the subject of research, documenting the successes and failures of socially differentiated farmers in using new technologies and institutional frameworks, and their attempts to define their own spaces.

A more accurate and reflexive assessment of cereal seed developments in Ghana would conclude that over the last twenty years there have been significant advances in the creation of new varieties. However, these new varieties are not perfect, and the proof of this is in their relative short-life before they are replaced by new released varieties. The success of the seed development system thus lies in its ability to address the problems of existing released varieties, and to generate a process of continual development of new varieties based on participatory evaluation by farmers. This in effect means that it is the process of seed generation in participation with farmers that is of critical importance. It is the creation of a re-iterative process of continually developing varieties in response to farmers' assessment that is important, and not the self-contained potential of any variety of certified seed as commodity.

Corporate lobbies are able to exert a powerful influence over agricultural research and the commodification of life forms. Bennet (2002:3) comments:

We are witness to the collapse of an entire system of values and its replacement, under the pressure of a now globalised privatisation, by another based exclusively on the cash relationship. It is a system already torn by internal weaknesses and contradictions, but within which we are cornered.

The claims and boasts that research scientists can breed miracle seeds that increase yield while responding to adverse factors such as drought is based upon the advances in learning made by farmer participatory research and upon genetic accessions collected from farmers own varieties. These varieties are the products of farmers' own learning, knowledge and experimentation in an open access environment, and on the cross fertilisation of knowledge between science and farmers. The displacement of these varieties by the African Green Revolution of subsidised commercial agriculture, the creation of legislation and regulations that favour intellectual property rights for varieties developed by commercial breeders, and the erosion of the process through which public research releases new varieties to farmers for evaluation and planting threatens the processes and premises on which plant breeding in complex and risky environments has been based over the last twenty years.

End Notes

- ¹ The state's role in creating an agricultural infrastructure to meet the interests of agribusiness in Africa is given considerable weight in the World Bank's World Development Report 2008. See Amanor (2009).
- ² Spore is produced by the Technical Centre for Agricultural and Rural Cooperation (CTA) which operates under the Cotonou Agreement and is funded by the EU.
- ³ I am grateful to Dr J.M. Kombiok, a RELC coordinator, for his insights and explanation of the role of the RELC, interviewed 8 January 2010 at SARI, Nyankpala.
- ⁴ Interviews with to Dr J.M. Kombiok, 8 January 2010 at SARI, Nyankpala, and with Joseph Apeeliga and Shirley Bawane, ACDEP, Tamale, on 8 January 2010
- ⁵ Interviews with to Dr J.M. Kombiok, 8 January 2010 at SARI, Nyankpala and with Dr Roger Kanton, at Tamale on 11 January 2010.
- ⁶ A new Seed Bill has been drafted to make way for the complete commercialisation of seed production, but has not yet been passed by parliament.
- ⁷ Interview with Joseph Bapule and Patrick Apula of SSC on 7 January 2010.
- ⁸ Interview with Iddrisu Zakaria, SeedPAG President for Northern Region, 7 January 2010.
- ⁹ Information provided by Chris Akai, Chief Inspector of Regional Seed, GSID, Northern Region, 5 January 2010.
- ¹⁰ In the Northern Region the main ago-dealers are Wumpini, Vansado, Ganom, AyiZak, Kayoma, and Sugri Ago-dealers. These companies are largely based in Tamale, the regional capital. Wumpini and Ganoma have established subsidiary retail outlets in other towns. Ganoma has branches in Nyanpala, Savelugu and Yendi, and Wumpini have four retail outlets in Tamale, and one in Yendi, Savelugu, and Kpandai.
- ¹¹ Interviews with Wumpini on 5 January 2010, Hawa Ganoma of Ganoma Agro-Chemicals on 8 January, 2010, and with Kayoma Agro-Chemicals on 8 January 2010.
- ¹² See <http://www.ifdc.org/Projects/Current/GADD>
- ¹³ Interview with John Kelly and William Kotey, Yaara Ghana –Wienco, Tamale, 11 January 2010. See also <http://yarahana.com/Support-Services/Masara-N-Arsiki-Farmer-Association.aspx>

¹⁴ Technoserve is a non-profit business organization that provides business- and market-based solutions to poverty in developing countries, <http://www.technoserve.org/resources/jobs/>.

¹⁵ Interview with Joseph Apeeliga and Shirley Bawane, ACDEP, Tamale, on 8 January 2010.

¹⁶ Janet Chigabatia-Adama, Managing Director of Savanna Farmers Marketing Company Ltd, reported that at various meetings concerned with promoting new agricultural technologies disputes emerged between seed breeders, the GSID, and seed growers about their respective roles in the production of breeder, foundation and certified seeds, Interview 8 January 2010.

¹⁷ Interview with Dr J. M. Kombiok on 8th January 2010 at SARI, Nyankpala.

¹⁸ Interview with I.D.K. Atokple on 8 January 2010, at SARI, Nyankpala

¹⁹ Interview with Dr Roger Kanton on 11 January 2010, at Tamale.

²⁰ Interview with J.K Jimah at Nyankpala Rice Mill, 6 January 2010.

²¹ Interviews with grain traders were carried out in Tamale on 9 January 2010 at Central Market and on 11th January 2010 at Abuabu Market.

²² Interview with Chris Akai, Chief Inspector of Regional Seeds, GSID, Tamale on 5 January 2010.

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References

- Alebikiya, Malex (1993) 'The Association of Church Development Projects (ACDEP) in Northern Ghana', in Wellard, K. & Copestake, J. (eds.) (1993) *Non-Governmental Organizations and the State in Africa: Rethinking roles in sustainable agricultural development*, London, UK: Routledge
- Almekinders, C.J.M. and Elings, A. (2001) 'Collaboration of farmers and breeders: Participatory crop improvement in perspective', *Euphytica* 122:425-438
- Amanor, K. (1999) *Global restructuring and land rights in Ghana: Forest food chains, timber and rural livelihoods*, Research Report 108, Uppsala, Ghana: Nordic Institute of African Studies
- Amanor, K. (2009) 'Global Food Chains, African Smallholders and World Bank Governance' *Journal of Agrarian Change*, 9(2):247-262
- Amanor, K. and Pabi, O. (2007) Time, Space and Rhetoric in Agricultural Change in the Transition Zone in Ghana', *Human Ecology*, 35:51-67
- Aoki, K. (1998) 'Neocolonialism, Anti-Commons Property, and Biopiracy in the (Not-So-Brave) New World Order of International Intellectual Property Protection', *Indian Journal of Global Legal Studies*, 6:11-58
- Aoki, K. and Luvai, K. (2007) 'Seed Wars: Controversies over access to and control of plant genetic resources', in Peter K. Yu (ed.) *Intellectual Property and Information Wealth: Issues and practice in the digital age. Volume Two Patents and Trade Secrets*, Westport CT, USA: Praeger Publishers
- Ashby, J.A. (2008) 'Fostering Farmer First methodological innovation; Organizational learning and change in international agricultural research', in Scoones, I. and Thompson, J. (eds.) (2008) *Farmer First Revisited: Innovation for agricultural research and development*, Rugby, UK: Practical Action Publishing
- Barry, M., Pham, J., Noyer, J., Billot, C., Courtois, B., Ahmadi, N. (2007) 'Genetic diversity of the two cultivated rice species (*O. sativa* & *O. glaberrima*) in Maritime Guinea: evidence for interspecific recombination', *Euphytica* 154: 127-137
- Bates, R.H. (1981) *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies*, Berkeley CA, USA: University of California Press
- Baumüller, H. and Tansey, G. (2008) 'Responding to Change', in Tansey, G. and Rajotte, T. (eds.) (2008) *The Future Control of Food: A guide to international negotiations and rules on intellectual property, biodiversity and food security*, London, UK: Earthscan
- Bennet, E. (2002) 'The Summit-to-Summit Merry-go-Round' *Seedling*, July 2002, GRAIN
- Botchway, J. (1993) 'Implications of Farming and Household Strategies for the Organization of a Development Project', in De Boef, W., Amanor, K., Wellard, K. and Bebbington, A. (eds.) (1993) *Cultivating Knowledge: Genetic Diversity, Farmer Experimentation and Crops Research*, London, UK: Intermediate Technology
- Breth, S. and Dowsell C.R. (2003) *Sasakawa Africa Association, Annual Report 2002-2003*, Tokyo, Japan: Nippon Foundation
- Chambers, R. (1983) *Rural Development: Putting the Last First*, London, UK: Prentice Hall
- Cooper, F. (1996) *Decolonization and African Society: The Labor Question in French and British Africa*, Cambridge, UK: Cambridge University Press
- Cowen, M. and Shenton, R. (1994) *Doctrines of Development*, London, UK: Routledge
- CRI (1970) Annual Report, Kumasi, Ghana: Crop Research Institute
- CTA (2010) Donors Break Rank, Spore, No. 145 Centre for Agriculture and Rural Cooperation http://spore.cta.int/index.php?option=com_content&task=view&lang=en&id=1128&catid=10 [accessed on 20 August 2010]
- Daddieh, C.K. (1994) 'Contract Farming Palm Oil Production in Cote d'Ivoire and Ghana', in Little, P.D. and Watts, M.J. (eds.) (1994) *Living Under Contract - Contract Farming and Agrarian Transformation in Sub-Saharan Africa*, Madison WI, USA: The University of Wisconsin Press
- Dawson, J. (2002) 'Empowering Ghana's cereal producers in the marketplace', in Kapila, S. and Mead, D. (eds.) (2002) *Building businesses with small producers: Successful business development services in Africa, Asia and Latin America*, Ottawa, Canada: The International Development Research Centre
- Delimini, L.L. and Wobil, J. (1998) *Ghana Seed Sector Analysis*, a report prepared for the IITA/GTZ Project on the Promotion of Seed Production and Marketing in West Africa

- Eicher, C. (2003) *Flashback: Fifty years of donor aid in African Agriculture*, Conference Paper No. 16, a paper presented at 'Successes in African Agriculture' conference, 1-3 December, Pretoria, South Africa: In Went, IFPRI, NEPAD and CTA
- Farrington, J. and Martin, A. (1988) *Farmer Participation in Agricultural Research*, London, UK: Overseas Development Institute
- Friedmann, H. (2005) 'From Colonialism to Green Capitalism: Social movement and emergence of food regimes', in Buttel, F.H and McMichael, P. (eds.) (2005) *New Directions in the Sociology of Global Development*, Oxford, UK: Elsevier
- GRAIN (1992) 'Why farmer-based conservation and improvement of plant genetic resources', in Cooper, D., Vellvé, R. and Hobblerlink, H. (eds.) (1992) *Growing Diversity*, London, UK: Intermediate Technology Publications
- Grischow, J. (2006) *Shaping Tradition: Civil society, community and development in colonial northern Ghana, 1899-1957*, Leiden, The Netherlands: Brill
- Hajer, M. (1995) *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process*, Oxford: Oxford University Press
- IFDC (2002) *An Action Plan for Developing Agricultural Input Markets in Ghana*, Muscle Shoals AL, USA: International Fertiliser Development Center
- Keeley, J. and Scoones, I. (2003) *Understanding Environmental Policy Processes: Cases from Africa*, London, UK: Earthscan
- Kloppenborg, J. (1988) *First the Seed: the political economy of plant biotechnology*, Cambridge, UK: Cambridge University Press
- Konings, P. (1986) *The State and Rural Class Formation in Ghana*, London, UK: Routledge & Kegan Paul
- Kula, O. and Dormon, E. (2009) *Ghana Rice Study, a Global Food Security Response West Africa Rice Value Chain Analysis*, Washington DC, USA: United States Agency for International Development
- Lipton, M. (1977) *Why Poor People Stay Poor; urban bias in World Development*, Cambridge MA, USA: Harvard University Press
- McCann, J.C. (2005) *Maize and Grace: Africa's encounter with a New World Crop, 1500-2000*, Cambridge MA, USA: Harvard University Press
- Millar, D., Haverkort, B., van't Hooft, K., Hamistra, W. (2001) 'Challenging Developments: Approaches, results and perspectives for endogenous development', *Compas Magazine*, No 4:4-7
- MOFA (2009) *National Rice Development Strategy*, Accra, Ghana: Ministry of Food and Agriculture
- Monde, S.S., & Richards, P. (1992) Rice biodiversity conservation and plant improvement in Sierra Leone, in Putter, A. (ed.) (1992) *Safeguarding the genetic basis of Africa's traditional crops*, proceedings of the CTA/IBPGR/KARI/UNEP seminar, 5-9 October 1992, Nairobi, Kenya
- Norman, D. (1974) Rationalising mixed cropping under indigenous conditions: an example of Northern Nigeria, *Journal for Development Studies* 11(1): 3-2
- Nuijten, E. (2005) *Farmer management of gene flow: the impact of gender and breeding system on genetic diversity and crop improvement in The Gambia*, PhD Thesis, Wageningen University and Research Centre
- Puplampu, K. (2003) 'State-NGO Relations and Agricultural Sector Development', in Tettey, W. Puplampu, K. and Berman, B. (eds.) *Critical Perspectives in Politics and Socio-Economic Development in Ghana*, Leiden, The Netherlands: Brill
- Rhoades, R.E. and Booth, R.H. (1982) 'Farmer back to Farmer: A model for generating acceptable agricultural technology', *Agricultural Administration*, 11: 127-13
- Richards, P. (1985) *Indigenous Agricultural Revolution: Ecology and food production in West Africa*, Hutchinson: London, UK: Hutchinson
- Richards, P. (2009) 'Knowledge Networks and Farmer Seed Systems', in Scoones, I. and Thompson, J. (eds.) (2008) *Farmer First Revisited: Innovation for agricultural research and development*, Rugby, UK: Practical Action Publishing
- Roffe, P. (2008) 'Bringing Minimum Global Intellectual Property Standards into Agriculture: The agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)' in Tansey, G. and Rajotte, T. (eds.) (2008) *The Future Control of Food: A guide to international negotiations and rules on intellectual property, biodiversity and food security*, London, UK: Earthscan
- Sachs, J.D. (2005) *The End of Poverty: Economic possibilities for our time*, New York, USA: Penguin Press

- Sanchez, P., Swaminathan, M.S., Dobie, P., Yuksel, N. (2005) *Halving Hunger: it can be done*, UN Task Force on Hunger, New York, USA: Earthscan
- Scoones, I. (2008) 'Mobilizing against GM Crops in India, South Africa and Brazil' in, *Journal of Agrarian Change*, 8(2-3):315-344
- Shepherd, A. and Onumah, G.E. (1997) *Liberalised agricultural markets in Ghana: the role and capacity of government*, The Role of Government in Adjusting Economies Studies Paper 12, DAG, University of Birmingham
- Tripp, R. and Marfo, K. (1997) 'Maize Technology Development in Ghana During Economic Decline and Recovery', in Byerlee, D. and Eicher, C.K. (eds.) *Africa's Emerging Maize Revolution*, Boulder CO, USA: Lynne Rienner
- World Bank (1981) *Accelerated Development in Sub-Saharan Africa*, Washington DC, USA: The World Bank
- World Bank (n.d.) 'Support for Improved Technologies through Large-Scale Field Demonstrations in Ghana, SG 2000 Project in Ghana (May 1986-December 2003)', in *World Bank Fertilizer Toolkit: Promoting eEfficient and sSustainable Fertiliser use in Africa*, http://www.worldbank.org/afr/fertilizer_tk/.../GhanaSGDemoProgram.pdf [accessed 20 July 2010]
- Zerbe, N. (2001) 'Seeds of hope, seeds of despair: Towards a political economy of the seed industry in southern Africa', *Third World Quarterly*, (4):657-673

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