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Uganda's Dilemmas in the Transition to Modern Commercial Agriculture: Implications for the Poverty Reduction Agenda

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Acronyms

CAADP	Comprehensive Africa Agriculture Development Programme
CI	Commercialisation Index
DSIP	Agricultural Sector Development Strategy and Investment Plan
IP	Innovation Platform
NAADS	National Agricultural Advisory Services
NDP	National Development Plan
PMA	Plan for Modernisation of Agriculture

Summary

This paper draws on field data from farming households in Kabale and Kisoro districts of Uganda and early findings from monitoring the implementation of the Plan for Modernisation of Agriculture (PMA) and the Agricultural Sector Development Strategy and Investment Plan (DSIP) to investigate: (1) whether Uganda's agricultural modernisation strategies constitute the right mechanism and target of transforming smallholder subsistence agriculture into highly productive commercial farming; and (2) whether the generation and promotion of modern farm inputs pursued is sufficient to increase household farm output and incomes, or whether there is need for more rigorous market/economic incentives.

Several key findings emanate from this study. First, the overall logic of agricultural modernisation as laid out in the PMA/DSIP (increase household farm output and income) still holds, but there are weaknesses within the implementation process, with most of the pillars that seek to address agricultural marketing problems not being visible on the ground. Overall, progress in generating and promoting knowledge on modern farm inputs (hybrid seed, fertiliser and pesticide) is good. However, smallholder farmers lag behind in the adoption of these inputs despite the high demand for them. The low adoption levels of these inputs coupled with low literacy levels, small land sizes, low asset endowments and low access to credit limit the capacity of smallholder subsistence farmers to produce surplus for the market.

Second, results on market participation show that smallholder farmers have significantly lower production volumes and lower market participation. Yet households that had higher total crop output also had considerable market surplus and reported greater market participation. These results point to the strong relationship between output level, market participation and exiting poverty, and indicate the role that access to productive assets, which improve a household's capacity to produce marketable surplus, can play in poverty reduction. Chief among this paper's recommendations is the need to mainstream input and output marketing issues within all intervention areas and the development of more differentiated strategies according to target groups.

1. Introduction

1.0 Background

Poverty and declining agricultural productivity are deeply related problems in Uganda and all are likely to be exacerbated by the impacts of population increase, land fragmentation and climatic change (GOU 2010a; Ssewanyana and Kasirye 2010). With the country's population growing 3.4 percent annually (UBOS 2010), the labour force in the agricultural sector continues to expand, and yet this has not resulted in more growth in the sector (Table 1). Agricultural sector workers in Uganda face a number of challenges, including low application of productivity enhancing inputs; declining and degrading land resources; lack of agricultural finance; inadequate pest and disease control; weak policy, legal and regulatory frameworks; and inadequate agricultural infrastructure (GOU 2010a; 2010b). The sector is also vulnerable to price fluctuations (domestic, regional and international) and changing regional and international trading policies (GOU 2010a; 2010b). All of these factors and policy changes have significant impact on agricultural productivity, food security and farm incomes. Consequently, the long term success and sustainability of agricultural development and poverty reduction depend on the implementation of appropriate long-term measures that reduce farmers' vulnerability to these domestic and global changes.

Since 2000, the Government of Uganda has been implementing programmes targeted at transforming the country's largely smallholder subsistence farming into modern, high-productivity commercial farming, first through the Plan for Modernisation of Agriculture (PMA) 2000-2010 and now through the Agricultural Sector Development Strategy and Investment Plan (DSIP) 2010-2015. The rationale of the agricultural modernisation programmes Uganda has undertaken since 1987, and particularly since 2000, has been that agricultural growth would result from promoting research and technology development; agricultural advisory services; agricultural education; improved access to rural finance; agro-processing and marketing; liberalisation; privatisation; sustainable natural resource utilisation and management; and physical infrastructure development (GOU 2010a; 2000). Despite the implementation of these reforms, structural weaknesses in the Ugandan economy persist and agricultural supply and poverty reduction response to reforms among smallholder farmers remains weak (GOU 2010b; 2004b; Kappel et al. 2005; Okidi et al. 2005a).

The PMA/DSIP and National Development Plan (NDP) are unequivocal that while agriculture alone will not be enough to reduce poverty, empirical evidence and past experiences in Uganda, particularly in the 1990s (GOU 2010b), show that it is uniquely powerful in that task. Over the period 1987 to 2000, agriculture performed well, growing at an annual average of 3.8 percent – faster than the population growth rate (3.2 percent) at that time (UBOS 2007; GOU 2000). The sector is reported to have been a major contributor to the success of Uganda's poverty reduction efforts in the 1990s, with the proportion of the poor falling from 55.7 percent in 1992 to 33.8 percent in 2000 (Kappel et al. 2005; GOU 2004a). However, between 2000 and 2013 the sector grew at an annual average of only 1.9 percent (UBOS 2013). This growth of the agricultural sector is much below the country's NDP[2] annual growth target of 5.6 percent and the 5.9 percent growth rate that is required for effective poverty reduction (GOU 2010b). It is also below the six percent annual growth target of the African Union's Comprehensive Africa Agriculture Development Programme (CAADP)[3] (CAADP 2010).

In the past, agricultural production was largely a function of acreage, but as the Ugandan population continues to grow and land resources diminish, further growth in agricultural production will have to be driven by productivity growth resulting from application of land augmenting technology. The PMA/DSIP, NDP, CAADP and Alliance for a Green Revolution in Africa (AGRA)[4] all underscore the importance of adopting modern technologies (hybrid seeds, fertiliser, pesticides and insecticides) to increase agricultural productivity in the fight against poverty and hunger (Wellard, 2011b; GOU 2010b; 2000; Toenniessen et al. 2008). However, transforming traditional agriculture often requires, in addition to adopting new technologies and farm structures to meet the new demands for increased production, profound changes addressing market, political, social and institutional constraints (Wellard 2011a; Diao and Dorosh 2007). Past experiences elaborated by Huang et al. (2004) and Tsakok and Gardner (2011) in countries like China and Brazil further suggest that in the absence of deliberate policy efforts to target smallholder farmers, the poor are less likely to benefit from the process of agricultural transformation.

This paper, therefore, seeks to make a meaningful contribution to the wider policy debate on how to achieve pro-poor agricultural growth (Dorward et al. 2004; Ahluwalia et al. 1979) in Uganda. The Ugandan case is particularly interesting for the pro-poor growth debate because high agricultural and economic growth rates coincided with remarkable poverty reduction during the 1990s, but not in recent years (Kappel et al. 2005; Okidi et al. 2005b). Rather than revisit the debate regarding the role of agriculture in poverty reduction, the purpose of this paper is to investigate the current phase of the Government of Uganda's agricultural modernisation strategy and assess its sufficiency and effectiveness in meeting the development needs of the poor and vulnerable groups in Uganda. It asks whether the PMA/DSIP programmes being implemented represent the most effective mechanisms for transforming smallholder subsistence farmers into highly productive commercial farmers.

1.1 Agricultural Growth and Poverty Trends/Patterns in Uganda

Analysis of poverty trends in Uganda since 1992 show that the good economic growth rates (averaging 7.2 percent annually) (GOU 2010b) that Uganda has experienced over the past two decades translated into broad-based poverty reduction only during the course of the 1990s, whereas after 2000, growth appears to have favoured mainly the rich (Kappel et al. 2005; Appleton 2003). Income inequality, measured by the Gini coefficient, increased further during this latter period despite continued reduction in poverty. In Table 1 below, national poverty measured by the headcount of people falling below the $1 per day poverty line generally declined from 55.7 percent to 22.2 percent between 1992 and 2013. However, poverty reduction has been a rather volatile process, with little change in the early 1990s, much of the reduction occurring in the second half of the 1990s, then a reversal in the early 2000s and an improvement between 2005 and 2013.

Statistics in Table 1 provide further insight into the observed improvements in the standards of living of Ugandans, marked with increasing income inequality. Consistent with previous work on poverty in Uganda (Ssewanyana and Okidi 2007; Kappel et al. 2005; Appleton 2003; 2001), the country's 2013 Millennium Development Goals progress report demonstrates that poverty changes during the 2000s appear to have been driven mainly by increases in income, rather than by redistribution (UNDP 2013). Worsening income distribution during the 2000s implies that policymakers have to worry about inequality and develop policies that will promote more equitable pro-poor growth. Pro-poor growth requires that the pattern of growth be biased in favour of the poor (Kraay 2006; Okidi et al. 2005a; DFID 2004; Ahluwalia et al. 1979) and there is sufficient empirical evidence demonstrating that targeting the agricultural sector provides the best mechanism for reaching the poor (Kraay 2006; Doward et al. 2004).

Indeed, Kappel et al. (2005) and Okidi et al. (2005a) find that impressive growth in agriculture was the basis of Uganda's poverty reduction achievement in the 1990s. As illustrated in Table 1, the reduction of poverty within the agricultural sector was the main contributor to overall national poverty reduction in the 1990s as the headcount in this sector reduced by approximately 18.7 percentage points against 16.7 percentage points in the non-agricultural sectors (manufacturing, trade and construction). In contrast, between 1999/2000 and 2002/2003 agriculture was by far the most important contributor to the observed increase in poverty – the headcount in this sector increased by 8.4 percentage points against 3.4 percentage points in the non-agricultural sector. These trends suggest that good agricultural performance is strongly related to poverty reduction. Conversely, poor agricultural performance increases the incidence of poverty.

The impressive agricultural growth and poverty reduction rates that Uganda experienced during the 1990s have been attributed to the increased prices that producers received for their crops, largely resulting from important structural changes within agriculture towards a better market integration of farmers (DENIVA 2006). Because agricultural marketing was liberalised, farmers were able to benefit from the increase in the world price of coffee. The coffee boom of the mid-1990s is said to have played an important role in reducing poverty between 1992 and 2000 (Kappel et al. 2005). Between 2000 and 2003, poverty, especially among agricultural workers, increased massively (Table 1) due to slow growth in agriculture; declines in farmers' prices; population movement in a context of agricultural slowdown; and aggravated political insecurity in the Northern and Eastern parts of Uganda (Ssewanyana and Okidi 2007; GOU 2004a). The period 2005-2013 was marked, on average, with poverty reduction, though not as strong as that observed in the 1990s. The restoration of peace and resettlement in Northern Uganda since 2005 (UBOS 2010) seems to have hugely contributed to the positive poverty reduction trends observed during this period.

Table 1: Agricultural growth rate and poverty/inequality estimates (percent), 1992-2013

	1992	1993/ 1994	1994/ 1995	1996	1997/ 1998	1999/ 2000	2002/ 2003	2005/ 2006	2009/ 2010	2012/ 2013
Agricultural growth rate	9.2	2.3	6	2.6	2.1	5.5	2.4	0.5	2.2	1.4
National poverty level	55.7	51.2	50.2	49.1	44.4	33.8	37.7	31.1	24.5	22.2
Poor agricultural workers	59.5	-	49.3	-	-	40.6	49	34.7	28.6	-
Poor non-agriculture workers[5]	36	-	-	30	-	19.3	22.7	20.4	22.1	-
										Gini coefficient (income inequality)
National	0.36	0.35	0.36	0.37	0.35	0.39	0.43	0.41	0.43	0.44

Sources: Appleton 2001: 20, 23; Appleton 2003: 602-603; UBOS 2007: Tables 6.3.2, 6.3.5; UBOS 2010: Tables 6.9, 6.10, 6.11, 6.15, 6.20; UBOS 2013; GOU 2010b: Tables 6.8; Okidi et al. 2005b: 18

2. Methods and Study Area

The study employs both qualitative and quantitative methods and uses primary and secondary data. Secondary data was gathered from government-published economic surveys, statistical abstracts, previously published journal articles and working papers. Primary data was collected from 60 purposively selected farmers from Bufundi and Bubaare sub-counties in Kabale district and Chahi sub-county in Kisoro district, all located in South Western Uganda (Table 2) in June 2011. The sample size was deliberately kept small to enable in-depth exploration of the subject. These interviews sought to establish whether farmers are benefiting from the ongoing agricultural modernisation programmes by investigating: (a) farmers' knowledge and use of modern farm inputs; (b) factors considered when choosing to adopt a modern farm input; (c) the productivity and income benefits of using modern farm inputs; (f) the marketing opportunities/challenges they face; and (e) where farmers seek advice on agricultural production and on what topic (production, value addition, marketing or finance).

Table 2 provides a summary of the socio-economic characteristics of the surveyed farmers. The farmers interviewed fell under three broad categories, that is, those who sought agricultural advice from the government National Agricultural Advisory Services (NAADS)[6] , those who sought advice from community-founded farmer groups known as Innovation Platforms (IPs)[7] , and those who sought advice from neither NAADS nor IPs (non-IPs/NAADS)[8] . This categorisation aided in running segment data analysis in order to determine farmers' preferences.

Kabale and Kisoro districts were chosen as the areas of research because they are some of the poorer regions in Uganda, in which concerns of high population density, land fragmentation, declining soil fertility, high poverty levels and food insecurity are major development challenges. However, because of their close proximity to regional markets in Rwanda and Democratic Republic of Congo, this region has also been identified in Zonal studies by the Government of Uganda as a potential breadbasket in which smallholder commercial agriculture can be developed (GOU 2010a; ITAD 2008). Agriculture in these districts is characterised by a high concentration of Irish potato and sorghum. Agriculture (both crops and livestock) is the primary source of livelihood for all of the surveyed households.

More than 75 percent of the survey sample suggested that they are involved in farming because it is the only way to feed their families. This is of some concern because the PMA/DSIP is designed to promote food security and poverty reduction through the market as opposed to subsistence production. After agriculture, the farmers in the survey sample rely more on business and informal labour, which is essentially the rural informal sector. Hence, developing agriculture and the rural informal sector would be key intervention areas for helping the poor out of poverty. A high proportion of the smallholder farmers (70 percent) own less than one hectare of land, which is allocated between farm and non-farm activities.

Table 2: Socio-economic characteristics of the respondents

	Overall	Chahi sub-county	Bufundi sub-county	Bubaare sub-county
Location (district)	-	Kisoro	Kabale	Kabale
Number of households interviewed	60	28	16	16
Key employment and income source				
Farming (%)	100	100	100	100
Non-farm activities (business and informal labour) (%)	36.7	46.4	18.8	37.5
Both farm and non-farm activities (%)	36.7	46.4	18.8	37.5
Why farming is the main livelihood activity				
Source of food for home consumption (%)	75	78.6	68.8	75
To generate income (%)	51.7	39.3	68.8	56.3
Both for home consumption and income (%)	65	67.9	62.5	62.5
Average landholding size (ha)	-	0.7	0.4	0.6
Average distance to a motorable road (km)	-	1.2	5.81	0.78
Average distance to point of output sale (km)	-	3.7	10.6	2.28
Average distance to the point of input sale (km)	-	2.9	6.3	1.03
Average distance to extension advice (km)	-	2.2	3.25	0.93

Source: Survey data

3. Related Literature

A long-standing theoretical literature and empirical evidence supports the view that agricultural modernisation promotes agricultural growth and poverty reduction (see Hazell et al. 2007; Dorward et al. 2004; Jayne et al. 2002; Behrman 1982). Paradoxically, however, development theorists such as Mellor (1986), Behrman (1982), Rostow (1960) and Lewis (1954) demonstrate that as economies grow and poverty reduces, the relative importance of the agricultural sector reduces. This, together with increasing recognition of the diversity of poor rural people's livelihoods (James 2010: 360) and with difficulties in 'getting agriculture moving' in areas where most poor rural people live today (Wellard 2011a; Dorward et al. 2004), has led to questions about the importance of agriculture for economic growth and poverty reduction, about the benefits of attempts to promote directly agricultural growth and development, and about the best means to promote such growth (Jayne et al. 2002; Rostow 1960; Lewis 1954). Nonetheless, the following discussion attempts to identify dominant theories and narratives that have had major impacts on agricultural modernisation policy and practice since the 1950s.

In early development theory during the 1950s and 1960s, theorists were careful to couple agricultural modernisation to industrialisation. In their growth models, the role of agriculture in economic development was to merely support the growth and expansion of other sectors – industry and service sectors (Rostow 1960; Lewis 1954). The purpose of agriculture was to ignite economic growth by providing sufficient cheap food and labour to the expanding industrial economy, which was thought to be the dynamic 'leading sector' in economic development (Diao and Dorosh 2007; Jayne and Jones 1997; Sahn and Dorosh 1996; Rostow 1960; Lewis 1954). Lewis's famous two-sector model and Rostow's stages of economic growth are some of the most recognised growth models that place heavy emphasis on rapid industrialisation and economic growth with the agricultural sector fuelling this industrial expansion by means of its cheap and surplus labour (Todaro and Smith 2009; Lewis 1954).

Agricultural modernisation in the context of the early modernisation theory was therefore a macro-economic drive towards industrialisation and economic growth. One of the principal assumptions was that growth in the industrial sector, into which the poor from the agricultural sector are gradually transferred, would trickle down to the poor in the form of more industrial jobs and infrastructural development resulting from industrial expansion (Todaro and Smith 2009; Lewis 1954). From this perspective, agricultural transformation would be the 'black box' that would enable industrial take-off and promote economic growth, while the poor were expected to be passive receivers of agricultural growth (Ellis and Biggs 2001; Mellor 1986; Rostow 1960).

These early modernisation theoretical formulations had profound impacts on development thinking and practice in the 1960s and 1970s, during which the Green Revolution emerged and saw a global expansion of large scale commercial agricultural farms with the objective of increasing food supply and raw materials for the expanding agro-processing manufacturing industries (Ellis and Biggs 2001; Wiggins 2000). Another critical feature of agricultural policymaking during this period, as discussed by Ellis and Biggs (2001), relates to the poor pricing of agricultural commodities, especially food grains and other staples. In their pursuit of rapid industrial and urban development many of the developing countries, particularly in Africa, maintained low agricultural prices in an attempt to provide cheap food for the urban modern industrial sector which was thought to be the key growth sector (Ellis and Biggs 2001).

Although Lewis's and Rostow's economic growth models roughly reflect the historical experience of today's advanced economies, replicating these development models in developing countries has often been problematic (Todaro and Smith 2009). This is because some of their key assumptions do not fit the institutional and structural realities of most of today's developing countries (Todaro and Smith 2009). For instance, Lewis's two-sector model assumption that labour can freely move from the agricultural sector into the industrial sector (Lewis 1954) is based on another wrong assumption that the labour requirements between the two sectors are the same (Todaro and Smith 2009). Given that the industrial sector in developing countries is more capital intensive, demand for labour in this sector is low (Tiffen 2003; Mellor 1986).

As early as the 1970s, growing discontent with the modernisation economic growth models and discourses on agricultural modernisation by the critics of the modernisation theory began to shift from a focus on economic growth to poverty reduction (Ellis and Biggs 2001; Cleaver 1972). The argument extended by the critics of the early modernisation theorists is that a development approach which emphasises elimination of poverty through economic growth resulting from industrial expansion will have damaging effects on the lives of the poor and marginalised groups (Todaro and Smith 2009). The main factors identified in this critique are the constraints of bureaucratic top-down management techniques, elite capture of state policies, political distortion of policies, and urban bias associated with economic growth oriented development policies (Ellis and Biggs 2001; Cleaver 1972).

The anti-early-modernisation theorists do not disqualify economic growth as essential for poverty reduction but rather advance an argument that if sustainable agricultural growth is to take place and contribute to poverty reduction, it must begin with the poor in particular and the rural economy in general. It is upon these arguments that a number of researchers began to question the large scale Green Revolution technical fix approach in resource-poor farming regions and the 'trickle down' model (Evenson and Gollin 2003; Shiva 1992). Smale (1995), Evenson and Gollin (2003) and Toenniessen et al. (2008) report that attempts to promote a Green Revolution within Africa in the 1960s and 1970s largely turned out to be a failure basically

because agricultural extension policies during the 1960s and 1970s focused on promoting technological uptake by a small cadre of 'elite' or 'progressive' farmers who, it was theorised, would provide a demonstration effect to the poor farmers, resulting in a trickle down of new technology.

Whereas the Green Revolution technical fix approach went out of favour during the 1970s, the 1980s saw a resurgence of its main tenets, albeit in a modified form (Evenson and Gollin 2003; Ellis and Biggs 2001). It had now become clear that directly targeting the poor and addressing the socio-economic constraints they face in their production systems was paramount for the success of any agricultural modernisation strategy (Amanor 2010; Ellis and Biggs 2001; Wiggins 2000). Documentation on the Sasakawa Africa Association and Sasakawa Global 2000 initiatives during the 1980s (Amanor 2010) shows that these initiatives sought not only to diffuse improved agricultural technology to smallholder farmers but also to provide financial support for the maintenance of high input agriculture using certified seeds. Clearly, the focus of agricultural development by the 1980s was still on addressing supply side constraints in order to increase food supply, and little attention was paid to addressing demand side constraints in agriculture.

By the 1990s, concerns with the participation of the poor in technology research, development and dissemination and output markets began to be merged with human development approaches to development (Ellis and Biggs 2001). However, even with the emergence of farmer participatory paradigms in the 1990s, the core ideas behind agricultural modernisation as put forward by Lewis and Rostow and the technology transfer modes of the Green Revolution continue to dominate the development discourse and mainstream national agricultural and extension services in Africa and other developing countries today (see Amanor 2010; Toenniessen et al. 2008; World Bank 2008; Evenson and Gollin 2003; Ellis and Biggs 2001). Economic historians echo Lewis and Rostow in suggesting that the prime explanation for today's advanced industrial economies lies in their history of agricultural transformation and innovation along the different dimensions of institutions, technology, markets and the application of natural resources (Smith 2009; Todaro and Smith 2009; Juma and Yee-Cheong 2005).

In the widely acknowledged Taiwanese development experience starting in the 1950s (Lin 1986: 23, 54), it is documented that agricultural modernisation laid a firm foundation for industrialisation, which in turn led to broader economic development. Another case in point is the People's Republic of China, which has made a point of fostering a close and mutually complementary relationship between agriculture and industry (Huang et al. 2004). It adopted a policy of building up industry through agriculture and using industry to develop agriculture in order to attain a balanced development of both. In their study, Huang et al. find that agriculture made three major contributions to development of China. First, it satisfied the increased demand for agricultural products created by the rapid growth of both the economy and the population. Second, it provided the labour that the industrial sector needed to proceed with economic development. Third, it provided a portion of the capital needed for industrialisation.

The Chinese strategy of first stimulating agricultural growth and then using the resources of agriculture to aid in industrial development is strikingly similar to the approach that many development commentators suggest developing countries should adopt (Tiffen 2003). However, many development analysts point out that the development experiences of today's developed countries depended on the unique socio-economic and political conditions which they possessed at that time, and hence should not be considered as blueprints for developing countries to replicate (Smith 2009; Todaro and Smith 2009). Besides, today's developed countries too had setbacks and in some cases economic imbalances were created as a result of pursuing such development strategies (see Huang et al. 2004).

In the Chinese experience described above, despite its success in expanding agriculture and then gradually moving from import-substitution industries to manufacturing products for export, and finally to capital-intensive heavy industries (Huang et al. 2004), China saw a number of problems emerge in the agricultural sector. Ravallion and Chen (2004) note that with the rapid development of industry and commerce, the growth of farming incomes began to decline in China, and as a result agricultural incomes became relatively low. Similarly, in many cases where the Chinese approach has been used in developing countries, impressive agricultural growth has occurred without the poor receiving proportional benefits. Examples highlighted by Tsakok and Gardner (2011) include Brazil with its extremely unequal land distribution and Chile with its social injustices and inequality of access to key resources such as irrigation.

The cases of agricultural modernisation described in this section suggest that there should always be an analysis of the relationship between technology innovation in agriculture and the context of the technology recipient society. Similar views are held by Smith (2009) and Juma and Yee-Cheong (2005). Many critiques of the Green Revolution, for instance, point to the way hybrid crop varieties with their demands for fertilisers, irrigation, the purchase of seeds and the like forced smallholder farmers in Asia and Africa to reorganise the way they lived their lives and worked their land (Shiva 1992). Evenson and Gollin (2003) observed that whereas the green revolution was able raise the average cereal yields across large swathes of Asia, it significantly failed to increase yields in more marginal areas of Africa, and demanded that farmers engage in new and more intensive forms of agricultural production, in some cases dramatically altering their livelihoods and the risks they were obliged to take. Thus, according Evenson and Gollin the success of the green revolution and general agricultural modernisation in some parts of Asia represents neither miracles nor technological panaceas.

Given the risky nature of smallholder subsistence agriculture, Todaro and Smith (2009) emphasise that

when innovation and transformation fail to occur, careful examination of the environment in which the smallholder farmer operates should be done to search for the particular institutional or commercial obstacles that may be blocking or frustrating constructive change. In parts of Africa where agriculture has performed poorly, studies by Jayne et al. (2010) and Smale (1995: 21) reveal that smallholder farmers reluctantly responded to obvious agricultural modernisation innovation because (1) the landlord secured much if not all of the gain; (2) the moneylender captured the profits; (3) the government's 'guaranteed' price was never paid; or (4) complementary inputs (fertilisers, pesticides, assured supplies of water etc.) were never made available or their use was otherwise more problematic than outsiders understood. Thus, efforts to minimise risk and remove commercial and institutional obstacles to smallholder innovation are essential requirements of agricultural modernisation and poverty reduction.

4. Key features of Uganda's Agricultural Modernisation Strategy

If the primary objective of agricultural modernisation in Uganda is progressive improvement in the lives of the poor, it is important that the PMA/DSIP identifies the principal mechanisms of ensuring that the poor benefit more from growth in the agricultural sector. In what follows, a closer look at the key features of the PMA/DSIP and their relation to Uganda's poverty reduction agenda is conducted. The PMA/DSIP recognises that while agricultural modernisation is crucial to poverty reduction, sustainable agricultural growth and poverty reduction also depend, to a greater extent, on interventions beyond the agricultural sector (GOU 2000).

Accordingly, the PMA/DSIP identifies key constraints facing agriculture-based livelihoods and seeks to address them through several intervention areas, including research and technology development; agricultural advisory services; rural finance; agro-processing and marketing; agricultural education; supportive infrastructure; and sustainable natural resource use and management (GOU 2010a; 2000). Through these interventions, the PMA/DSIP aims to achieve two major objectives: (a) increasing output and productivity of smallholder agriculture; and (b) increasing market participation, incomes and food security of smallholder farmers through the market rather than emphasising self-sufficiency (subsistence production) (GOU 2010a; 2000).

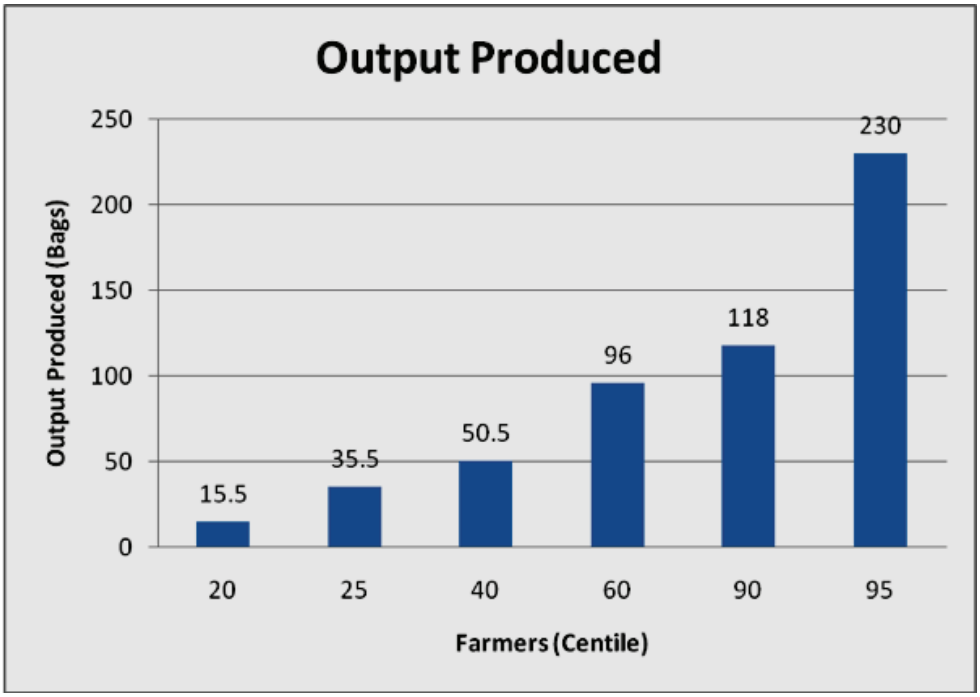
4.1. Increasing output and productivity of smallholder agriculture

4.1.1 The problem of low agricultural output and productivity in Uganda

As already mentioned, absolute poverty in Uganda is disproportionately concentrated among the rural smallholder subsistence farmers. Improvements in their incomes are therefore key to any agricultural modernisation strategy that seeks to generate great reductions in poverty. A first step in any such effort is enabling farmers to increase their output and productivity since increasing farmers' incomes requires that there be a marketable surplus for them to sell and earn income (CAADP 2010; Hazell et al. 2007). Increasing the productivity of smallholder agriculture in Uganda is crucial for poverty reduction because pro-poor agricultural growth requires that smallholder farmers be the engine of growth (Hazell et al. 2007; Dorward et al. 2004). Secondly, the multiplier effects of improving smallholder agriculture (employment creation, resource utilisation and incomes) are also higher (Wellard 2011b; Hazell et al. 2007) since smallholder agriculture forms a major source of employment and income for many unskilled and semi-skilled workers in Uganda (GOU 2010a). Hence the labour intensive nature of smallholder agricultural provides the best channels to reduce poverty.

However, smallholder farmers in Uganda are not well placed to generate the high rates of agricultural growth needed to deliver great reductions in poverty (GOU 2010b). National agricultural growth trends in Table 1 demonstrate that output and productivity levels among farmers in Uganda have generally been very low over the past decade. Agricultural growth rate during the 2000s occurred at a mere annual average of 1.9 percent as compared to 3.8 percent annual average growth rate in the 1990s (UBOS 2013; GOU 2000). Consistent with the national agricultural growth rates, levels of output among the surveyed households are significantly low in the lower deciles. Output also increases faster in the top 40 percent of the farmers as compared to the lower 40 percent of the farmers. These differences in output levels and output growth rates between farmers in the lower and upper deciles is an indication of the productivity inequalities that exist between smallholder farmers and medium/large scale farmers. At low levels of agricultural output and productivity, farmers become vulnerable to food insecurity during bad weather seasons (Jayne et al. 2010) and are not able to take advantage of good agricultural prices when they arise during periods of economic boom or when markets open up due to market liberalisation and globalisation (Jayne et al. 2001).

Figure 1: Household crop output level (bags)



Source: Survey data

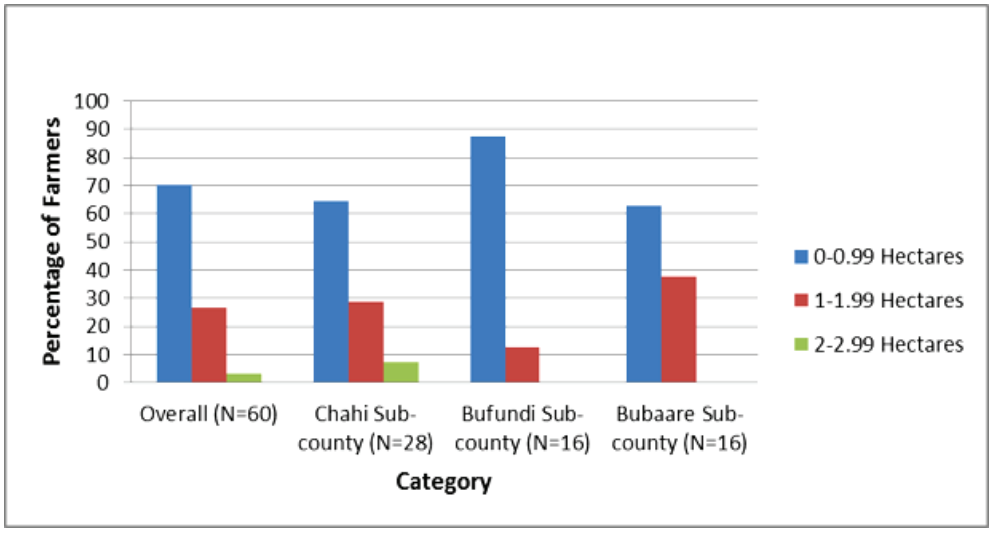
Through the PMA/DSIP, the government of Uganda has been pursuing strategies aimed at increasing agricultural productivity as this has been seen to be central to accelerating agricultural incomes and improving the wellbeing of the rural and urban poor (GOU 2010a; 2010b; 2000). However, as noted by Hubbard and Smith (1999), one of the principle challenges of transforming agriculture is how to get the role of the government right in ensuring that growth and productivity improvements in the agricultural sector occur in ways that benefit the poor and other vulnerable groups. Inadequate understanding of the problems that smallholder farmers face and the right mechanisms needed to address their problems has been found to be the prime reason for many failures in attempts to promote pro-poor agricultural growth (Hubbard and Smith 1999).

According to James (2010), a first step in understanding what is needed for pro-poor agricultural growth must, therefore, be a comprehension of the production and productivity constraints that poor smallholder farmers face; which in turn helps in understanding and identifying the particular interventions that would best benefit the poor. But even after identifying the constraints, Jayne et al. (2010) notice that there is always a tendency for policymakers to place more emphasis on addressing supply side constraints than the demand/market side constraints. This is probably because many development policies continue to wrongly assume that the problem of low agricultural output and productivity is largely a supply side phenomenon (limited land, limited labour, low quality seeds/pesticides/fertilisers etc.) (Toenniessen et al. 2008; Godman and Smith 1995). While it is true that supply side constraints play a significant role in limiting output, several empirical studies have also demonstrated that in the absence of proper demand side interventions (price and tax incentives, for instance), poor smallholder farmers will lack the motivation to increase output even when the supply side constraints are addressed (Diao and Dorosh 2007; Benin 2004).

The low-productivity subsistence nature of most of Uganda's traditional agriculture is attributed to the limited amount of land that a farm family can cultivate in the context of traditional knowledge and technology (GOU 2010a; 2010b; UBOS 2007). Similarly, survey results in Figure 2 show that a limited amount of land is the top most pressing production and productivity problem facing smallholder farmers in Uganda. Overall, about 70 percent of the surveyed household possess less than one hectare of land, which is allocated between farm and non-farm activities.

The problem of limited land cuts across Uganda. Household landholding size in Uganda is generally low with 80 percent of Ugandans owning less than two hectares (UBOS 2007). In any agrarian economy like Uganda, land is the basic factor of production in agriculture and is a primary form of collateral security (UBOS 2010). A lack of it, or possession of low amounts of it, means that one can only do small scale farming and cannot have access to formal credit (GOU 2010a). Land fragmentation was also identified as a key agricultural development challenge in the surveyed region. The small fragmented pieces of land tend to be intensively cultivated, and as a result, they are subject to declining fertility and rapidly diminishing returns as more units of labour and capital inputs are applied (GOU 2010a). Furthermore, the introduction of mechanised agriculture on these small, fragmented and scattered pieces of land is no longer feasible (GOU 2010a). Even then, in many rural areas of Uganda where land is scarce and

Figure 2: Landholding size of surveyed households



Source: Survey data

labour is abundant (UBOS 2010), the introduction of heavily mechanised agriculture is not only ill suited to the physical environment but, more importantly, also has the effect of creating more rural unemployment (Pingali 1989). Additionally, given the financial and land constraints, there is a high likelihood of mechanised techniques excluding women and smallholder farmers, hence widening the productivity gap between males and females and between smallholder and large scale farmers (Pingali 1989).

Natural calamities such as pests and diseases and the impacts of climate change further worsen the problem of low and fluctuating agricultural output among surveyed households (Table 3) and generally among smallholder farmers in Uganda (GOU 2010a). The interplay of all these factors, coupled with lack of ready markets and unstable agricultural prices, increases the uncertainties within agriculture and keeps smallholder farmers in a vicious cycle of poverty characterised by low output/productivity leading to low marketable surplus, low income, low productive capacity (land, credit etc.) and further low output/productivity.

4.1.2: Are modern farm inputs sufficient to increase agricultural output and productivity in Uganda?

In the context of limited land and declining soil fertility, the government emphasises that further growth in agricultural production in Uganda will have to be driven by productivity growth resulting mainly from the application of modern biological and chemical innovations (GOU 2010b; 2000). Key among Uganda's PMA/DSIP strategies is the increased generation, promotion and use of modern farming inputs and technologies, particularly improved seed, fertiliser and pesticides (GOU 2010a). Empirical literature shows that where biological and chemical innovations have been properly used, particularly in parts of East Asia (Tsakok and Gardner 2011; Huang et al. 2004; Lin 1986) and Kenya (Ariga and Jayne 2006), they have been found to be land augmenting, highly effective and to offer enormous benefits in raising agricultural output. However, they are not without their own problems. The major challenge is how to extend these technological innovations to smallholder farmers in developing countries like Uganda (Jayne et al. 2010; 2002).

Table 3: Key production and productivity constraints that smallholder farmers face

Constraint	No. of farmers (n=60)	Percentage
Low household landholding size	33	55
Pests and diseases	32	53
High cost of inputs (seed, fertiliser and pesticides)	29	48
Limited access to agricultural credit	22	37
Low quality of inputs	20	33
Declining soil fertility	19	32
Poor transport and storage facilities	16	26.7
Limited market and unstable output prices	11	18.3
Unpredictable weather	9	15

Source: Survey data

Biological and chemical innovations offer potential for continued smallholder farm progress as well as overcoming the food crisis problem (Huang et al. 2004) that has characterised much of the developing world and Africa in particular in the last two decades (Toenniessen et al. 2008). However, the social institutions and government economic policies that often accompany their introduction, particularly in African farming systems, are not always scale neutral (Berry 1993). On the contrary, they often merely serve the needs and the vested interests of the few resource rich individuals like wealthy land owners and large scale agricultural farms, while smallholder farmers who are in most need of these innovations are bypassed (Evenson and Gollin 2003; Jayne et al. 2002).

Within the PMA/DSIP policy framework, both formal and informal systems are seen to be important channels for delivering these agricultural inputs to Ugandan farmers (GOU 2010a; 2000). While the formal input delivery system is an important source of high quality certified inputs (Amanor 2010; GOU 2010a; Odame and Muange 2010), Table 4 shows that the informal system is the most popular sources of inputs for smallholder farmers. Due to financial constraints and limited access to agricultural credit, smallholder farmers lack the capacity to purchase the relatively expensive but good quality certified inputs from the formal seed delivery system (GOU 2010a). The majority of the farmers therefore rely on the informal seed delivery system and often recycle seed that has been exhausted through generations of cultivation. The result has been persistently low yields (GOU 2010a).

The informal input sources identified in this study include household own/retained seed/fertiliser/pesticides, neighbour/farmer, family friend, relative and purchases made from input traders through informal markets. Inputs, particularly seed purchased from these sources, comprise mainly local varieties whose quality is low and not certified (Odame and Muange 2010). Formal input sources, on the other hand, are those made from stockists and government outlets through which inputs are certified.

Most farmers in Uganda produce for subsistence reasons and hence input related activities tend to be integrated and locally organised, coming from informal input systems. The informal system, as highlighted in Table 4 embraces most of the ways in which farmers themselves generate, disseminate and purchase inputs: directly from their own harvest; through barter among friends, neighbours and relatives; and through local grain markets and traders (Odame and Muange 2010). Because of its local specificity to needs and preferences, the informal system provides most of the inputs that farmers use (Amanor 2010; Odame and Muange 2010).

Despite the importance of informal input systems to many smallholder farmers, informal systems are constrained by the policy and regulatory framework within which they operate (Ariga and Jayne 2006). Ariga and Jayne cite that in many cases, the legal, regulatory and policy frameworks tend to favour the formal system, which most often overlooks the unique technology needs of smallholder subsistence farmers. As a result, the formal system tends to serve a few privileged, highly productive commercial farmers. There is no doubt that the informal input system will continue to play an important role in input access and utilisation among smallholder farmers in Uganda. However, as discussed by Amanor (2010), a well-functioning input delivery system is one that allows for broad participation of formal, informal, market and non-market channels to efficiently meet farmers' demands for quality inputs.

There is therefore need for the Ugandan government to address input market failures by developing input delivery systems and structures that minimise adverse selection by the input sellers and encourage wide access to and use of improved quality inputs by smallholder farmers. The liberalisation of agricultural input marketing in Uganda in the early 1990s provided space for private sector participation in agricultural input markets, thus reducing the monopoly inefficiencies that previously characterised much of the government run input delivery system (GOU 2010b; DENIVA 2006).

The essence of the liberalisation was to encourage local and foreign investment in the agricultural input industry and stimulate growth in breeding, production and marketing (DENIVA 2006; 2005). These measures would impact directly in making new technologies accessible to farmers (DENIVA 2006). While it was widely expected that this would promote competition and efficiency in the input industry and lead to improved accessibility of quality inputs, the rate of adoption of modern inputs (seed, fertiliser and pesticides) among the

Table 4: Sources of agricultural inputs (seed, fertiliser and pesticides)

Source	Formal/Informal	Farmers (%) n=60	Reason
Own/retained seeds	Informal	66.7	Cheap and readily available
Input trader	Formal/Informal	51.7	Not cheap but most reliable
Neighbour/farmer	Informal	25	Relatively cheap but not reliable
Family/ friend	Informal	23.3	Cheap but unreliable
Farmer group	Informal/Formal	20	Not very cheap but reliable
Government agency	Formal	18.3	Relatively cheap but not reliable
NGO agent	Formal	11.7	Relatively cheap but not reliable

Sources: Survey data; Odame and Muange 2010

poor has generally remained low and their agricultural productivity continues to decline (GOU 2010a). The following section provides a discussion on why the rate of adoption and use of improved farm inputs remains low despite the numerous structural and institutional reforms in input delivery systems that Uganda has undertaken since 1987.

4.1.3 Adoption and use levels of modern farm inputs

Contrary to the common perception that smallholder subsistence farmers are conservative in adopting modern farm practices (Toenniessen et al. 2008; Evenson and Gollin 2003; Smale 1995), the findings of this study reveal that the demand for knowledge on modern farm inputs (approximated by the proportion of farmers who seek extension advice on hybrid seed, fertiliser and pesticides) among smallholder farmers is high. Data in Table 5 presents the proportion of surveyed farmers who regularly/sometimes sought knowledge and advice on modern farm inputs between June 2010 and June 2011 and those who did not seek any advice on these inputs. Overall, the proportion of farmers who regularly and/or occasionally sought advice is 85 percent. This also represents those farmers who are willing to adopt modern farm inputs ('Willing Adopters') since, according to DANIDA (2005), seeking advice on these inputs can be taken to as an expression of one's willingness and desire to adopt them.

On the other hand, only 15 percent of the surveyed households did not seek advice on modern farming between June 2010 and June 2011 ('Non-willing Adopters'). Data presented in Table 5 also show that willingness to adopt modern farm practices is highest among farmers that belong to farmer groups (IPs) and lowest among farmers that neither receive extension support from NAADS nor belong to any farmer group. These results demonstrate the importance of farmer groups in building farmers' capacity to access agricultural extension advice and articulate their interests through collective action and institutions (Hellin et al. 2006).

However, as highlighted by Ariga and Jayne (2006), a key issue with modern farm inputs and their impact on agricultural output and productivity is not just their generation and promotion but their adoption and use by farmers. It is of serious concern that whereas the proportion of the surveyed farmers that seek extension advice on modern farm practices is relatively high at 85 percent (Table 5), only 27.5 percent of the farmers were found to be regularly using modern farm inputs (Table 6). Again, there is a strong positive correlation between farmer group membership and the rate of adoption and use of modern farm inputs; as farmers from IPs made the biggest contribution to the overall number of farmers who regularly use improved farm inputs (Table 6). This could be due to the fact that organised farmer groups and co-operatives expand the flow of information and support availability to farmers and this increases individuals' willingness to adopt modern farm inputs and potentially also increase their output (Hellin et al. 2006). The farmers argue that belonging to a farmer group enables them to understand their own constraints, and to have access to relatively cheap credit, inputs and sufficient knowledge and training on the use of these inputs.

4.1.4: Factors that influence adoption/use levels of modern farm inputs

The rate of adoption and use of modern farm inputs is said to vary across socio-economic groups, and is influenced by a number of factors both at the household level and community level (Smith 2009; Ariga and Jayne 2006). Table 7 provides some insights into the factors that determine a farmer's decision on whether or not to adopt and use a modern farm practice. An understanding of these factors helps in charting out policy options that can lead to greater access and high adoption of modern inputs, thereby resulting in increased productivity.

The sentiments expressed by farmers who actively use modern farm inputs indicate that the appropriateness of any new form of biological and chemical innovation play a significant role in influencing a farmer's decision on whether or not to adopt it. Appropriateness, as recorded from the survey findings, relates to: (1) the expected benefits (output/income) from using the inputs; (2) appropriateness of the inputs to the local environment (land tenure system); and (3) the sustainability (cost) of using these inputs over a long period of time. This means that under favourable socio-economic conditions, smallholder farmers will adopt high yielding farm practices as long as they find them appropriate to their development needs.

This finding is also shared by the PMA evaluation (DANIDA 2005; GOU 2004b) and NAADS assessment (ITAD 2008) studies which reported financial capital constraints as a major obstacle in the adoption of productivity enhancing technology by smallholder farmers, who without a source of finance will remain vulnerable and resort to using poor quality, low yielding farm inputs acquired from informal input delivery systems. Therefore, the PMA/DSIP pillar of expanding rural microfinance is one of the most important, and if appropriately targeted may improve rates of technological uptake and use.

The PMA/DSIP recognises private local microfinance institutions as best placed to meet the needs of the rural poor because of their wide coverage (GOU 2004b; 2000). Rather than being a source of credit itself, the government aims at providing, under the PMA/DSIP, an enabling environment for microfinance institutions to grow and thrive (GOU 2010a; 2004a; 2000). However, a significant amount of work remains to be done, especially with regard to improving the outreach of financial institutions to rural areas and instituting mechanisms that encourage formal institutions to lend to agricultural farmers at affordable interest rates (GOU 2010a).

Data from the field survey also indicate significant geographical differences in the perceived barriers to the adoption of improved farm inputs. For instance, more individuals in Bufundi sub-county (rural) were more concerned by the high transaction/transport costs because of a poor road network and long distances to the

Table 5: Proportion of farmers (%) who seek/do not seek advice on modern farm inputs

	Overall n=60	Sub-county			Farmer segment		
		Chahi n=28	Bufundi n=16	Bubare n=16	IPs n=27	NAADS n=18	Non-IPs/NAADS n=15
Yes (%)	56.7	67.9	31.3	62.5	81.5	44.4	26.7
Sometimes (%)	28.3	25	37.5	25	18.5	50	20
No (%)	15	7.1	31.3	12.5	0	5.6	53.3
Total (%)	100	100	100	100	100	100	100

Source: Survey data

Table 6: Proportion of farmers (%) who apply/do not apply extension advice on modern farm inputs

	Overall n=51	Sub-county			Farmer segment		
		Chahi n=26	Bufubndi n=11	Bubaare n=14	IPs n=27	NAADS n=17	Non-IPs/NAADS n=7
Sometimes (%)	39.2	46.2	27.3	35.7	51.9	23.5	28.6
Yes (Actively) (%)	27.5	23	18.2	42.9	40.7	11.8	14.3
No (%)	33.3	30.8	54.5	21.4	7.4	64.7	57.1
Total (%)	100	100	100	100	100	100	100

Source: Survey data

point of extension advice and input sale (Table 2) than individuals from Bubaare and Chahi sub-counties who were more concerned by the lack of sufficient credit and extension support. It is commonly perceived that private traders and input suppliers tend to locate and confine their businesses close to towns and market hubs where infrastructure is relatively well developed (Olwande and Mathenge 2010). Long distances to purchase points may imply high transport and transaction costs in acquiring inputs which can inhibit use (Olwande and Mathenge 2010; Ariga and Jayne 2006). Consequently, farmers residing in the more rural areas are largely cut off from input markets and extension services, with obviously adverse impacts for technology adoption, farm productivity growth and poverty reduction.

The survey findings in figures 7&8 on the factors that influence a farmer's decision on whether or not to adopt and apply a modern farm practice are similar to findings from earlier PMA evaluation studies. DANIDA (2005: 87), for instance, identifies household income level, size of land holding and past experience with the use of modern farm inputs as the key determinants of technology adoption (see also GOU 2010a; 2004b; ITAD 2008). In Table 9 a summary of these factors and how they influence the adoption of modern farm inputs is given. Generally, those with high income and more land holding size as well as some experience with using modern farm inputs are found to be more likely to adopt new technological innovations in farming than their counterparts. These results point to the strong relationship between income level and access to modern inputs, and indicate the role that access to productive assets, which improve a household's capacity to produce market surplus, can play in poverty reduction.

In summary, findings from this study reveal that low income levels, less borrowing capacity and less productive assets lower farmers' capacity and willingness to adopt high yielding farm inputs. This is challenging because NAADS targets those farmers who already have some productive assets (land) and skills (ITAD 2008). Furthermore, NAADS operates in areas where farmers are classified as having some inherent potential (high income and more borrowing capacity), on the principle that they can direct the flow of instruction, technology and interventions down to the poorest, thereby indirectly pulling them out of poverty and reducing the burden on the agricultural budget (ITAD 2008).

The NAADS preferences identified here suggest that those targeted may be those most willing to change and have the capacity to adopt better farming methods. This creates a problem of adverse selection in input delivery programmes, whereby the 'progressive' farmers and 'active' poor are targeted at the expense of the poor and smallholder farmers. Whereas the approach of first targeting the more willing and progressive farmers ensures that resources are most efficiently used (ITAD 2008), there will be limited direct support for the most vulnerable groups (Dorward et al. 2004).

The sentiments expressed by those farmers willing to adopt and those less willing to adopt modern farm inputs in this study suggest two important things. First, that it is crucial to tailor interventions so that they meet the farmers' preferences (James 2010) and technology needs

Table 7: Why farmers apply extension advice and knowledge on modern farm inputs

	Overall n=34	Sub-county			Farmer segment		
		Chahi n=18	Bufubndi n=5	Bubaare n=11	IPs n=25	NAADS n=6	Non-IPs/NAADS n=3
Appropriate (%)	82.4	88.8	60	81.8	84	83.3	100
Timely (%)	64.7	77.8	40	54.5	68	50	66.7
Affordable (%)	52.9	55.6	20	63.6	56	33.3	33.3
Extension worker recommended (%)	2.9	5.6	0	0	0	16.7	0

Source: Survey data

Table 8: Why farmers do not apply extension knowledge on modern farm inputs

	Overall n=17	Sub-county			Farmer segment		
		Chahi n=8	Bufubndi n=6	Bubaare n=3	IPs n=2	NAADS n=11	Non-IPs /NAADS n=4
Cannot afford (%)	88.2	87.5	100	66.7	50	90.9	100
Not appropriate (%)	35.3	12.5	66.7	33.3	0	27.3	75
Not interested (%)	35.5	25	50	33.3	50	18.2	75
Too time demanding (%)	0	0	0	0	0	0	0

Source: Survey data

and skill requirements (Smith 2009). Secondly, because new technologies such as hybrid seeds, fertiliser and pesticides require access to complementary inputs such as credit, land and agricultural extension and training (Ariga and Jayne 2006; Evenson and Gollin 2003), if these are not also provided to smallholder farmers then the effective impact of agricultural modernisation can be the further impoverishment of many smallholder farmers, the widening of the gap between the rich and poor and the increased consolidation of agricultural land in the hands of a very few so-called high potential and progressive farmers.

Thus, whereas the introduction of biological (hybrid seed) and chemical (pesticides and fertiliser) innovations offer continued smallholder farmer progress and are preconditions for sustained improvements in levels of agricultural output and productivity, the success or failure of such efforts depends not only on their generation and promotion, but also more importantly on the farmer's ability and skill in adopting and applying them. Adopting a new biological or chemical innovation in turn depends on the commercial, economic and institutional conditions under which a farmer functions. Specifically, according to Eicher (1995) and Goldman and Smith (1995), a subsistence farmer will respond more to new technological opportunities to improve their output if they can have reasonable and reliable access to crop market information and marketing facilities; if they receive a fair market price for their output; and if they can feel secure that they and their family will be the primary beneficiaries of any improvement. In fact, farmers from such diverse countries as Colombia, Mexico, Ghana, Nigeria, Malawi, Zimbabwe, India, Pakistan and Thailand were found to be very responsive to price incentives and economic opportunities (tax subsidies) and made radical changes in what they produced and how they produce it (World Bank 2008; Eicher 1995; Goldman and Smith 1995; Smale 1995).

Many development analysts, therefore, now argue that if governments are to promote further increases in agricultural production that make a large impact on poverty reduction through modern technologies, they must not only make appropriate institutional and structural adjustments in farm production but also provide market incentives for smallholder farmers by implementing pricing policies (Benin 2004). Therefore, when smallholder farmers become reluctant to adopt new and improved farm practices, it should not be assumed that they are conservative (Smale 1995). Instead, a careful examination of the economic and market environment in which they operate should be conducted to identify the particular commercial and economic obstacles that may be constraining constructive change.

Table 9: Factors that influence a farmer's decision to adopt and use modern farm inputs

Factor	Comment
Years using modern farm inputs	- Those with some experience, even small, are more likely to adopt than those with none. - Steady increase in adoption as experience with modern inputs increases.
Household income level and borrowing capacity	- Households with considerably high income level can afford to purchase new input varieties, hence are more willing to adopt new technologies. - They also have access to credit to purchase inputs.
Size of land holdings	- Steady increase in adoption as total household landholding size increases. - They also can use land as collateral to acquire input credit.
Regional variables	-Those most distant from centres of extension advice and points of input sale are less likely to adopt.

Sources: DANIDA 2005: 87; ITAD 2008; GOU 2010a

4.2. Increasing market participation and incomes of smallholder farmers

Until the late 1980s, there was little mention in the policy arena of the marketing problems that smallholder farmers in developing countries face in their farming operations (Ellis and Biggs 2001). In Uganda, for instance, much of the earlier policy interventions in the agricultural sector prior to the liberalisation of agricultural marketing in the early 1990s focused on addressing supply side constraints (providing inputs and credit) as a means to boost the supply of agricultural products (DENIVA 2006), which of course is a crucial first condition for growth and poverty reduction (Okidi et al. 2005a). Recently, however, following economic liberalisation in many developing counties and opening up of markets through globalisation, studies and development policy have paid more attention to the demand side constraints and the role of markets in agricultural development (see Diao and Dorosh 2007).

It has been argued that market-oriented production can generate welfare gains through specialisation and comparative advantage (Gebreselassie and Ludi 2008), economies of scale and regular interaction and exchange of ideas (Olwande and Mathenge 2010). Unfortunately, the poor who need this kind of welfare benefits may be constrained by several factors in their quest to participate as sellers in output markets. The data analysis in the following section, therefore, focuses on the characteristics of smallholder farmer households and their participation in output markets as sellers. Critical questions relate to the degree of market participation by the smallholder farmers, key constraints to market participation and the relationship between market participation and transition out of poverty.

4.2.1 Degree of market participation among smallholder farmers

Table 10 presents data on the degree of market participation among the surveyed households using a simple index, the commercialisation index (CI). As adopted from Gebreselassie and Ludi (2008), the commercialisation index in this study is defined in output terms (not value terms): the proportion of household crop sales as a percentage of the household crop produce. This is because, whereas the main crops in the survey (Irish potatoes and sorghum) have the same unit of measurement (bags), the unit price for each crop is significantly different. The index could produce distorted results if commercialisation is measured in value terms, and consequently the interpretation of the degree of market participation would be inaccurate. Defining CI in output terms ensures that the huge differences in crop values that would arise from the differences in crop unit prices are eliminated (Gebreselassie and Ludi 2008).

Therefore;

$$\text{Commercialisation Index (CI)} = \frac{\text{Household Crop Sales (bags)}}{\text{Household Crop Produce (bags)}} \times 100$$

A commercialisation index of zero percent signifies a completely subsistence household, whereas a value of 100 percent signifies a totally commercialised household. The closer the index is to 100 percent, the higher the degree of market participation and commercialisation (Gebreselassie and Sharp 2008). Borrowing from Gebreselassie and Sharp (2008), the degree of market participation among the farmers in the survey sample is categorised under four CI ranges, that is: (a) Very Low Market Participation (CI value < 25 percent); (b) Low Market Participation (CI value 26-50 percent); (c) High Market Participation (CI value 51-70 percent); and (d) Very High Market Participation (CI value > 75 percent).

Overall, results on the degree of market participation in Table 10 demonstrate that the surveyed households have significantly low levels of market participation. 61.7 percent of the surveyed farmers consume more than 50 percent of their crop produce, while 39.3 percent sell more than 50 percent of their crop produce. A majority of the farmers (50 percent) fall under the category of Low Market Participation, that is, they sell between 25 percent and 50 percent of their crop produce and consume 50 percent or more of their produce.

Again, farmers that belong to organised farmer group(s) (IPs in this case) have a higher degree of market participation than farmers that receive extension service from the government funded NAADS and those that belong to neither IPs nor NAADS. In Table 10, 29.6 percent of the IP farmers fall under the category of Very High Market Participation as compared to 11.1 for NAADS farmers and zero percent for non-IPs/NAADS farmers. The relatively high degree of market participation among IP farmers is attributed to the advantages of collective marketing that come with belonging to a farmer group (Hellin et al. 2006). Market participation is also higher among farmers who are located closer to a motorable road and/or point of output sale (Bubaare and Chahi sub-counties) (Table 2) as compared to farmers who are located in more remote areas (Bufundi) (Table 2). These geographical differences highlight the role that access to good infrastructure plays in increasing market participation (Olwande and Mathenge 2010) and suggest the need for government to tailor interventions according to specific community needs.

With 61.7 percent of the surveyed farmers consuming more than 50 percent of their crop produce, this signifies that the degree of subsistence production in the survey sample is high. These results closely match with the views expressed by the surveyed farmers in which 75 percent state that they are engaged in agriculture because it is their major source of food for home consumption (Table 2). The level of subsistence farming in Uganda is generally high, with 70 percent subsistence farmers out of the approximately 80 percent of Ugandans engaged in agriculture (GOU 2010a). This is a big challenge to Uganda because a large subsistence sector means that PMA/DSIP interventions that seek to increase household farm income and reduce poverty through the market will have little impact on the poor and smallholder farmers because of their low degree of participation in output markets as sellers. Improving rural incomes and meeting the challenge of poverty in Uganda will therefore require some form of transformation out of the subsistence production system that currently characterises much of Uganda's agricultural sector, to a more commercialised agriculture.

4.2.2 Does high output translate into high market participation and income?

Through the PMA, the Government of Uganda has been implementing programmes aimed at increasing output and productivity of smallholder subsistence agriculture because this has been found to be key to increasing market participation and household income (GOU 2010a; 2010b). A broad range of academic and policy literature statistically links low levels of market participation by smallholder farmers to low farm output (Wellard 2011c; World Bank 2008; Benin 2004). Many agricultural development analysts further argue that at low levels of farm output, a farmer is unable to generate a sizeable marketable surplus to sell to the market (Wellard 2011c; Jayne et al. 2010; World Bank 2008).

Indeed, the survey findings presented in Figure 3 below suggest a very strong positive correlation between output produced and output sold. In Figure 3, the positively sloped scatter plot indicates that higher levels of output sold correspond to higher levels of output produced and vice versa. This means that households with higher level of crop output sold considerably more than their counterparts with lesser crop produce. This implies that a farmer with lower levels of crop produce is willing to market a very small proportion of their output, while one with considerably high farm output will be more willing to market a considerably larger proportion of their output.

Whereas a farmer's level of crop produced (and what they eventually market) provides some insight into the extent of their participation in output markets, the possibility that market participation will increase a farmer's income level depends on factors beyond their degree of market participation (Jayne et al. 2010; 2001). What this means is that participation in the market does not necessarily guarantee that a farmer's income will increase. On that note, Jayne et al. (2001) have suggested that a careful examination of the market conditions under which a farmer operates should be conducted to determine whether a farmer's participation in the market generates them surplus income. Jayne et al. argue that in order for a farmer to sell their farm output and increase their income, revenue from their crop sale must be higher than the production costs. Otherwise, if a farmer participates in the market while at the same time incurring high marketing costs (market dues, transport costs) and high input costs relative to their crop revenue, then they are less likely to increase their income (Jayne et al. 2001). Therefore, the degree of market participation as measured by the CI is an insufficient determinant of a farmer's level of income and greater market participation does not guarantee that a farmer's income will increase.

Agricultural marketing in Uganda is currently constrained by a number of factors related to a poor road and transport network; narrow domestic and foreign markets; low quantity and quality of output; high marketing costs (transport and market dues); and poor communication, information systems and facilitating services including research and extension (GOU 2010a). These constraints exist at different levels ranging from location level constraints that tend to influence participation at community scale to household level constraints that influence participation across households within a given location (Diao and Dorosh 2007). For instance, more farmers from more remote areas like Bufundi sub-county reported more infrastructure related challenges than those from Bubaare and Chahi sub-counties whose distance to a motorable road or

Table 10: Degree of market participation among smallholder farmers (percentage)				
Commercialisation index	**Overall n=60**	**Farmer segment**		
		IPs n=27	NAADS n=18	Non-IPs/NAADS n=15
Very Low (CI <25%)	11.7	7.4	5.6	26.7
Low (CI 26-50%)	50	44.4	55.6	53.3
High (CI 51-75%)	21.7	18.5	27.8	20
Very High (CI >75%)	16.7	29.6	11.1	0
Total	100	100	100	100

Source: Survey data

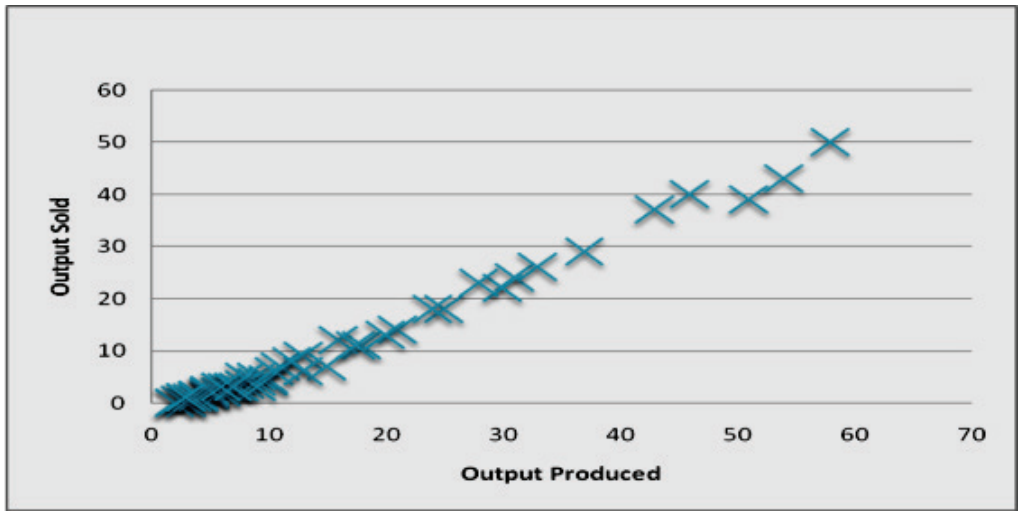
point of output sale is much closer than from Bufundi (Table 1). Because of poor road and communication infrastructure, farmers from Bufundi sub-county registered more marketing problems than those from Chahi and Bubaare. Segment analysis also reveals that farmers who belong to organised farmer groups (IPs) experience fewer marketing problems than the NAADS farmers and non-IPs/NAADS farmers.

The PMA/DSIP accords considerable effort to address the marketing problems in Uganda, although there appears to be weaknesses within the implementation process. Previous studies on the implementation of the PMA (DANIDA 2005) show that considerable progress has been made towards addressing the supply side constraints although interventions on agro-processing, marketing and developing supportive infrastructure which seek to address the market side constraints are still lagging in implementation and are not yet visible on the ground. As a result of this coordination failure in the implementation process, potential synergy among the interventions has not been achieved and this reduces the potential impact on poverty reduction of the services provided, and raises questions over the sustainability of the agricultural modernisation programmes in Uganda.

Given that poor road infrastructure in Uganda is among the key constraints on smallholder farmers' access to the market (GOU 2010a; 2010b; 2000), the construction and maintenance of feeder roads as well as community roads should be a priority for any strategy that seeks to increase smallholder farmer access to agricultural markets. However, Olwande and Mathenge (2010) cite that improvements in physical infrastructure do not guarantee greater access and participation in agricultural markets, as regulatory and other weaknesses within the markets will act as bottlenecks to greater market participation if not addressed. For Jayne et al. (2001), many market failures such as information asymmetries, missing markets, monopoly power and capital market failures simply limit the ability of smallholder farmers to take advantage of opportunities of globalisation when governments liberalise trade. They add that if these problems are not addressed prior to deregulation or making other structural and infrastructural changes, the poor smallholder farmers can remain excluded and even end up worse off (Jayne et al. 2001).

Another critical factor that could enhance market participation for smallholder farmers in Uganda is the need to improve the value of output (GOU 2010a; World Bank 2008). Efforts to add value to the output of smallholder farmers, for example supporting the development of agro-processing industries, would go a long way in minimising the competition that they face with large monopoly farmers and also increase the

Figure 3: Scatter plot for output sold against output produced



Source: Survey data

demand for their output in high value food chains like supermarkets both locally and internationally (World Bank 2008). Efforts to improve the flow of market information to the farmers should also be pursued. Improving farmers' access to market information will increase farmers' knowledge on the available markets and prevailing prices and enable them to make informed production and marketing decisions to optimise returns (Benin 2004).

5. Discussion and Conclusion

Poverty and declining agricultural productivity are deeply related problems in Uganda and both are likely to be exacerbated by the impacts of population increase, land fragmentation and climatic change. With the country's population growing by 3.4 percent annually, the labour force in the agricultural sector continues to expand and yet this has not resulted in more growth in the sector. The NDP and PMA/DSIP, therefore, place agriculture at the centre of the development agenda, in a vastly different context of opportunities and challenges. The PMA/DSIP and NDP are unequivocal that while agriculture alone will not be enough to reduce poverty, past experiences and empirical evidence show that it has been uniquely powerful in that task. This renewed interest in agriculture also comes in the context of volatile global food prices, declining agricultural production and diminishing land productivity.

Through the PMA and now the DSIP, the Government of Uganda has been implementing agricultural modernisation programmes since 2000 aimed at increasing output and productivity of smallholder subsistence agriculture because this has been found to be key to increasing market participation and incomes of smallholder subsistence farmers. In order to achieve these objectives, the Government of Uganda identifies key constraints facing agriculture-based livelihoods and seeks to address these through several intervention areas including: research and technology development; agricultural advisory services; rural finance; agro-processing and marketing; agricultural education; supportive infrastructure; and sustainable natural resource use and management.

The above interventions cover many of the same areas of support that governments have recently applied to agricultural development and poverty reduction. Proper implementation of these interventions is therefore crucial in moving the majority of the Ugandan population out of poverty and also for the wider economy. In the context of diminishing land and declining soil fertility due to population pressure, the Government of Uganda seeks to boost agricultural output through the application of productivity enhancing inputs. Key among the strategies is the generation and the promotion of modern biological and chemical innovations among smallholder farmers, particularly the use of hybrid seed, fertiliser and pesticides. These inputs have been found to be land-augmenting; that is, they improve the quality of existing land by increasing yield per hectare and can be applied effectively on small and large farms, hence offering potential for continued progress among smallholder farmers. However, the social institutions and economic policies under which they operate tend to favour large scale commercial farmers. NAADS interventions, for instance, target those farmers who already have some productive assets (land) and skills on the principle that they can direct the flow of instruction, technology and interventions down to the poorest, thereby indirectly pulling them out of poverty and reducing the burden on the agricultural budget. This means that farmers considered to have fewer or no productive assets are likely to be bypassed by NAADS interventions.

Contrary to the general perception that smallholder farmers are conservative in adopting modern farm inputs, 27.5 percent and 39.2 percent of the surveyed farmers were found to be actively and occasionally seeking extension advice on improved farm inputs respectively. However, a key issue with modern farm inputs and their impact on agricultural output and productivity is not just their generation and promotion (providing extension advice) but their adoption and use by farmers and other stakeholder. It is of serious concern that whereas the demand for extension advice among the surveyed farmers is high, only 27.2 percent were actively using modern farm inputs. These farmers face numerous and wide-ranging challenges to access affordable good quality inputs and these include high cost of inputs, unavailability of inputs and lack of knowledge on the advanced technology. Lack of information on type of inputs suitable for particular regions has often brought confusion among farmers, leading to crop failures. This often discourages the farmers from continuing to purchase and use these inputs. There is therefore need to tackle the key factors influencing the adoption of modern farm inputs, both from the demand and supply perspectives. These include making seed available and affordable to the farmers and strengthening extension services for farmers.

Additionally, mechanisms to protect poor smallholder farmers from malpractices (overcharging) by informal credit and input providers need to be put in place. The sentiments expressed by farmers that were less willing to adopt improved farm inputs suggest that it is crucial to tailor interventions so that they meet the farmers' preferences, technology needs and skill requirements. Secondly, because new technologies such as hybrid seeds, fertiliser and pesticides require access to complementary inputs such as credit, agricultural extension and training, if these are not also provided to smallholder farmers, the effective impact of agricultural modernisation can be the further impoverishment of many peasants, widening of the gap between the rich and poor and the increased consolidation of agricultural land in the hands of a very few so-called high potential and progressive farmers.

However, transforming traditional agriculture and reducing poverty often requires tacking institutional and market constraints in addition to promoting new technologies and farm structures. An understanding of the major role that participation in output markets plays in the production decisions of smallholder farmers suggests that biological (hybrid seeds) and chemical

(fertilisers and pesticides) innovations in farming are not sufficient to increase output and household incomes among subsistence agriculturalists. These changes must be accompanied by appropriate policies aimed at increasing the degree of market participation of farmers in output markets as sellers. The degree of subsistence agriculture in Uganda is generally high, with 70 percent subsistence farmers out of the approximately 80 percent of the Ugandan population engaged in agriculture. This is a big challenge to Uganda because a large subsistence sector means that agricultural modernisation interventions aimed at increasing household farm income and reducing poverty through the market will have little impact on the poor and smallholder farmers because of their limited participation in output markets as sellers.

Despite the liberalisation of agricultural marketing in Uganda since the early 1990s, agricultural marketing remains vulnerable and is constrained by poor infrastructure and access to markets, lack of market information, a concentration on low-value crops and a lack of post-harvest processing technologies. Domestic demand, dampened by low incomes and high market transaction costs, is inadequate to translate increased agricultural output into increases in rural incomes. Long-term global declines in agricultural commodity prices have also undermined the profitability of agriculture as a business. Moreover, Uganda faces new challenges from globalisation, resulting in increased competition both from other developing countries and from wealthy countries with agricultural subsidies. Growing concentration and integration of international markets, as well as increasingly demanding standards in terms of quality and food safety, pose additional challenges.

If these marketing constraints are not addressed, the poor will continue to have less access to and participation in markets. The PMA/DSIP accord considerable effort to address the marketing problems in Uganda, although there appear to be weaknesses within the implementation process. PMA implementation evaluation studies show that considerable progress has been made towards addressing the supply side constraints, although agro-processing, marketing and developing supportive infrastructure which seek to address the market side constraints are still lagging in implementation and are not yet visible on the ground. As a result of this coordination failure in the implementation process, potential synergy among the interventions has not been achieved and this reduces the potential impact on poverty reduction of the services provided, and raises questions over the sustainability of the agricultural modernisation programmes in Uganda.

Another critical issue that needs urgent attention is the need for land reform to be part of the broad strategy to increase smallholder farmer output and productivity. Land reform is more urgent in Uganda today than before, primarily because (1) income inequalities and unemployment have worsened over the last decade (see Table 1); (2) rapid population growth threatens to further worsen existing inequalities; and (3) recent and potential technological breakthroughs in agriculture can be exploited primarily by the large and powerful landowners and hence can result in an increase in their power, wealth and capacity.

In summary, smallholder subsistence agriculture is a very risky venture and since the basic concern of those engaged in it is their survival and that of their families, subsistence farmers tend to be risk averse to new farming systems – more so when these introductions are not backed by adequate economic/market incentives. It is thus important that in any agricultural modernisation and poverty reduction strategy, demand side constraints receive as much policy focus and implementation strength as the supply side constraints. A mixture of interventions that seek to enable smallholder farmers to better utilise their resource (land and labour), have access to quality farm inputs and get good prices for their output would go a long way in accelerating agricultural growth and incomes among poor agricultural households.

Consistent with Todaro and Smith (2009), this study argues that any effective agriculture-based poverty reduction strategy in Uganda should fulfil at least three basic complementary elements, that is: (1) accelerated output growth through technological, institutional and price incentive changes designed to raise the productivity of smallholder farmers; (2) rising domestic demand for agricultural output through improving backward and forward linkages between agricultural and non-agricultural sectors; and (3) diversified, non-agricultural, labour intensive rural development activities that directly and indirectly support and are supported by the farming community. The principle of the PMA/DSIP to respond to local needs, if implemented effectively, could therefore potentially offer the best opportunity for policymakers and development practitioners to adopt community specific interventions that will generate greater and faster increases in both agricultural growth and household incomes.

End Notes

1 Early Career Research Fellow, Future Agricultures Consortium.

2 The NDP was adopted in 2010 to replace the 1997 Poverty Eradication Action Plan (PEAP) as Uganda's national framework to guide public action to eradicate poverty. It has been prepared through a consultative process involving central and local Government, Parliament, donors and civil society. The current NDP covers the fiscal period 2010/11 to 2014/15. It stipulates the country's medium term strategic direction, development priorities and implementation strategies (GOU 2010b: 1).

3 CAADP is an African-led and African-owned strategic framework to guide country development efforts and partnerships in the agricultural sector of individual countries. CAADP aims to help African countries reach a higher path of economic growth and poverty reduction through agriculture-led development. CAADP directs investment to four mutually reinforcing pillars: (1) extending the area under sustainable land management and reliable

water control systems; (2) improving rural infrastructure and trade-related capacities for market access; (3) increasing food supply, reducing hunger and improving responses to food emergency crises; and (4) improving agriculture research, technology dissemination and adoption.

4 AGRA is a Rockefeller Foundation initiative established in 2006 to work towards achieving a food secure and prosperous Africa through the promotion of rapid, sustainable agricultural growth based on smallholder farmers. AGRA works to transform smallholder agriculture into a highly productive, efficient, sustainable and competitive system through supporting good seeds and healthy soils; access to markets, information, financing, storage and transport; and policies that provide them with comprehensive support (Toenniessen, Adesina and Devries 2008: 240).

5 Non-agricultural workers include those in manufacturing, construction and trade.

6 NAADS is a Ugandan programme under the Ministry of Agriculture, Animal Industry and Fisheries, which was created under the PMA to support government efforts to reduce poverty. The NAADS programme is responsible for the provision of agricultural advice to farmers. Agricultural advice may include better farm management practices, market information, new technologies and where to access inputs. NAADS does not provide credit or loans to farmers, does not supply inputs to farmers, does not market output on behalf of the farmers, does not fix prices or negotiate producer rates with buyers and does not procure land for farmers (ITAD 2008: 14; GOU 2004; 2000: xi, 55).

7 IPs in Uganda are a multi-stakeholder initiative of the Sub-Saharan Africa Challenge Programme, a programme supported by the Department for International Development (DFID) of the United Kingdom. It brings together different stakeholders including farmers, researchers, processors and traders into groups (IPs in this case) to generate and share knowledge on the best agricultural practices. IPs are a major vehicle for driving integrated agricultural research, information dissemination and market searching and discovery by linking farmers to high value chain actors. In Uganda, they are currently only found in Kisoro district (Chahi IP), Kabale district (Bufundi IP and Bubaare IP) and Ntugamo. This study only focused on Kabale and Kisoro districts. Farmers within IPs voluntarily come together with a common objective of increasing agricultural output and market participation (http://www.slideshare.net/CIAT/subsaharan-africa-challenge-program).

8 For purposes of this study, farmers in this category are literally considered to mean those farmers who do not receive or seek any extension advice from either NAADS or IPs. However, they could be seeking/receiving extension advice from other sources: neighbours, friends, family, input dealers or output traders. What particularly distinguishes this group of farmers from the IPs/NAADS farmers is that the former individually organise their farm activities, not collectively as in the case of IPs.

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