IESE Instituto de Estudos Sociais e Económicos

Productivity Constraints in African Agriculture

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Conference Paper N°51

II Conferência IESE

"Dinâmicas da Pobreza e Padrões de Acumulação Económica em Moçambique"

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II Confêrencia do IESE,

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Maputo, 22 a 23 de Abril de 2009

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Abstract

The paper begins by reviewing briefly some common diagnoses of productivity constraints in African Agriculture. It argues that these diagnoses tend to reproduce a rather limited set of ideas and assumptions that need to be questioned more seriously than is often the case. In particular, the paper suggests that the 'exceptional' challenges posed by Africa's mix of crops and 'agroecological complexity' are often overplayed, although the exceptional difficulties of infrastructure, institutions and markets are probably not. The paper considers more specifically the particular implications of different approaches to technical improvement of productivity in farming. It argues that a weakness in most current approaches is that they fail to pay sufficient attention to labour productivity in farming or the realities of rural labour movement and labour markets. The paper concludes by outlining four main areas in which research needs to take a new approach to investigating the constraints to agricultural productivity improvement, and the relationship of these to rural poverty. Specifically, these include: the existing and potential stimulus to agriculture from urban markets and regional markets; the relationship between private investment in agriculture and investment in 'public goods' (e.g. water infrastructure and pest control); the differential effect of productivity growth on different social groups in rural areas; the implications of growing agricultural productivity for labour relations and property rights.

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Introduction: Diagnosing Productivity Constraints in African Agriculture

Low productivity in African agriculture has been the focus of recurring concern at least since the 1930s, when colonial governments perceived growing impoverishment among rural populations in many parts of Africa. This was a period of worldwide crisis in agriculture, reflecting the more general reduction in economic activity and employment that constituted the Great Depression, and governments in many countries responded with interventions to support agriculture both technically and financially. An underlying theme to such intervention was the need to modernise agriculture to improve productivity, both to raise agricultural incomes and also to prevent degradation of the land. This latter point was informed by the 'dust bowl' ruin of farmers in the mid-west United States, attributed to the application of inappropriate technology to soils prone to drought and erosion. This narrative of 'land degradation' was taken up by colonial authorities in Africa as the explanation for rural impoverishment and informed much of the increasing intervention of colonial authorities in African agriculture in the decades of the 1940s to the 1960s. The heavy emphasis on soil protection is particularly evident in the 'contour bunds' and terracing introduced by the British authorities throughout eastern and central Africa, and in the 'betterment' schemes implemented in the South African 'bantustans'.

This historic perspective is important for it continued to be reflected decades later in many influential diagnoses of African farming problems, as for example: "unable to increase yields, increasing numbers of poor people put pressure on the environment – mining soils, destroying forests, and depleting wildlife stocks…" (IFAD, 1994). This paper does not wish to dispute that increasing population in *some* areas may be accompanied by declining productivity. Rather, it argues that this view of a simple 'malthusian' contradiction between increasing population and a fixed land area does not accurately conform to empirical reality in many African contexts, and more importantly (as in the United States in the 1930s) does not allow an understanding of the ways in which agriculture is linked to the fortunes and possibilities of the wider economy.

More recent diagnoses of constraints that apply to African farming contexts reflect a search for a more differentiated analysis, and in particular a need to identify what differentiates African contexts from those of other less-industrialised economies. Thus, the *World Development Report 2008* (World Bank, 2007) states that the absence in Africa of a 'green revolution' of the kind that increased agricultural productivity in Asia in the 1970s is due to: a "broader mix of crops", a greater degree of "agroecological complexity and heterogeneity", and a "lack of infrastructure, markets and supporting institutions". (World Bank, 2007: 160). This suggests two lines of analysis of *technological* change: progress in improvement of crop varieties, and more effective management of ecological constraints to agricultural productivity. I shall consider each in turn before returning to questions of 'infrastructure and institutions'.

Seeking Africa's 'green revolution'

Four examples of improved crop varieties in use in Africa are commonly identified: hybrid maize in eastern and central Africa, disease-resistant cassava, 'new rice for Africa' (Nerica), and disease-resistant beans. With the exception of hybrid maize, bred and produced commercially in South Africa and Zimbabwe since colonial times, initially for large-scale European-owned farms and subsequently extended to small-scale African farming, all these improved varieties originated in International Agricultural Research Centres (IARCs) funded since the 1960s by philanthropic organisations, and government international aid budgets through the Consultative Group on International Agricultural Research (CGIAR). The reputation of the IARCs was initially established by the development in the 1960s and 70s of wheat and rice varieties (based on *Norin* varieties created by Japanese government scientists in the 1930s) that formed the basis of the green revolution in Mexico, India and South East Asia. Following this initial success, and increasing funding, more IARCs were established embracing other crops (potatoes, cassava, grain legumes) and specific agro-ecological conditions: humid tropics (IITA in Nigeria), semi-arid tropics (ICRISAT in India), and dry areas (ICARDA in Syria). In each case, however, development of improved crop varieties for small-scale farming was at the core of IARC activity, with numerous collaborative trials with local (national) research organisations. In principle, IARCs constituted 'open-access' hubs of crop germplasm development with which national crop improvement programmes could exchange breeding material.

In the late 1980s, however, a number of changes took place. Firstly, the severe budgetary difficulties of African governments following the collapse in primary commodity prices in the early 1980s was followed by funding cuts and retrenchments that curtailed agricultural research capacity in much of Africa. Secondly, following two decades of growth, total annual real expenditure of IARCs reached a plateau in the late 1980s which has been maintained to the present, despite further increases in the number of IARCs (Pardey et al. 2007, 58) that effectively spread the budget more thinly. Finally, the research focus of IARCs was broadened to include improving the management of 'crop, livestock and natural resource systems' (e.g. agroforestry at ICRAF, water management at IWMI). The shift in emphasis was such that such research on 'sustainable production systems' now accounts for 35% of total CGIAR funding, double the share (18%) allocated to genetic improvement of crops (World Bank, 2007:163). Part of the reason for such a shift may have been the advent of biotechnology, and particularly the identification of molecular markers for genetic traits, which Pardey et al. (2007, 17) observe sharply increased the potential profitability of commercial investment in seed improvement by strengthening seed companies' ability to impose inventors' charges and restrict seed-saving and exchange by farmers. Previously this facility had been restricted to 'F1'–hybrid seed and thus to relatively few crops (notably maize, as observed above), but could henceforth be envisaged for any crop. In contrast to this enhanced appropriability of (commercial) returns to crop improvement, benefits arising from research on 'disembodied farm management practices' are 'the least appropriable of all' (Pardey et al. 2007, 17). Whether or not there was any explicit link between the increased CGIAR research focus on 'less apropriable' technologies and the changing interest of commercial biotechnology companies since the 1990s, the World Bank (2007:163) states that the application of biotechnology to crop improvement is 'concentrated largely in the private sector, driven by commercial interests, and not focused on the needs of the

poor.' As a consequence, the Bank argues that it is urgent to increase public investment in 'pro-poor crops and traits at both international and national levels' (World Bank, 2007: 165). It envisaged this as being achieved principally through significant renewal of philanthropic funding (e.g. the Gates Foundation) for public sector biotechnology development in poorer developing countries.

What effect such an initiative would have on rural poverty in Africa is hard to say, partly because there are few examples of publicly-funded biotechnology applied to agriculture, and partly because even the extent and impact of conventionally improved crop varieties on poverty have only begun to be investigated systematically since the mid- 1990s (Adato and Meinzen-Dick 2007, xix). Of the four crops mentioned above as having benefitted from varietal improvement, cassava most clearly benefits the poor, for whom it is often a drought-tolerant staple grown in poor soils, with planting material farmers themselves multiply by cutting and replanting stem sections. The impact of the new rice for Africa (Nerica) is as yet unclear due its comparatively recent development. Improved varieties of beans and maize are also likely to be important crops for the poor, although the widespread use of hybrid maize by smallholder farmers has generally required the purchase of both seed and fertilizer, and government subsidies for these inputs in Zimbabwe and Malawi have in recent decades resulted in major increases in maize production by African smallholders (Rukuni and Eicher 1994, Harrigan, 2003). While seed saving of improved maize varieties is feasible (though with reduced yields in the case of hybrid seed), lack of access to fertilizer is a serious limitation for the poor, who – due to limitations of land and/or labour - are less likely to be able to use manure from livestock or other 'soil fertility replenishment' approaches using leguminous shrub crops as fallows or compost (Place et al. 2007).

To a large extent all improvement of conventional crops, and particularly cereal crops, confronts limits of productivity imposed by environmental conditions (in the African context: pests and diseases, and lack of water or mineral nutrients) that have typically been overcome by 'green revolution' fertilizer, pesticides and irrigation technology. For many of Africa's smallholders, the cost of such investments is beyond their means or not justified by the value of the crop (due to low market demand). However, it is clear that there are genetic traits identified by biotechnology that offer benefits to African agriculture at potentially lower long-term cost, such as a naturally-occurring maize gene conferring resistance to a herbicide that kills a parasitic weed (*Striga*). A public-private consortium including an IARC and the Kenyan Agricultural Research Institute is exploring the incorporation of the gene in locally-adapted maize and applying tiny quantities of herbicide as a seed coating (De Groote and Kanamplu, in Pardey et al. 2007, 36). Setting aside for present purposes the enduring anxieties over 'genetic pollution' arising from widespread use of transgenic crops, the potential of public sector biotechnology is most clearly indicated by the Chinese development of insect-resistant 'Bt-cotton' that has been incorporated in local crop breeding programmes and has not only raised yields but also reduced pesticide use. A rather different insight is offered by Herring's (2007, 17) observation that, even where property rights of biotechnology companies are formally enforceable, as in India, the high prices of official 'Bt-cotton' seeds (produced in this instance by US multinational Monsanto) has had the result that: 'biotechnology has invigorated a vigorous anarchic and artisanal agrarian capitalism through the spread of stealth seeds'. Referring to 'creolised' unauthorised 'Bt-cotton' grown on millions of

hectares, he argues that, once introduced into crops, transgenes resemble more 'open-source linux than microsoft'. The possibilities of crop improvement relevant to poorer African farmers may therefore be said to remain far from fully explored so far. Public investment is likely to deliver varieties more accessible to the poor, but it is not assured. Continued reliance on commercial crop improvement is likely to favour commercial producers but also carries with it a risk of anarchic 'creolisation' of commercial crop varieties where high returns to agriculture provide incentives for 'informal' seed producers.

Envir**onmental management routes to improved productivity**

While the prospect of pest-resistant crops that reduce or eliminate the need for other inputs, such as pesticides, appears a clear gain to agricultural productivity, the returns to innovations which seek better agronomic and environmental management are more open to question. This has two principal reasons. Firstly, data on environmental degradation and its impact on land productivity are 'scarce and debated' (World Bank, 2007: 191), and the African context has supplied a particularly rich source of debate about the nature of environmental degradation (Anderson and Grove 1987; Leach and Mearns 1996; Thomas and Middleton 1994; Tiffen et al. 1994). The contentious nature of much of this literature is partly a matter of reliability of knowledge, particularly when measurements are aggregated or extrapolated from smaller to larger scale. The routine assertion by UN agencies that 'over 45 percent of Africa is affected by desertification' (UNEP, 2006), for example, are not supported by a framework of evidence or analysis that addresses the diversity of African ecological and social contexts. Debates about the extent of environmental degradation are also a matter of interpretation, since all environmental change is to some extent perceived through a lens of values that define positive and negative relationships between humanity and nature. In this regard, understanding of African environments has been exceptionally burdened since colonial times by thinking that has attributed environmental causes to economic and social problems. As observed in the introduction to this paper, particularly influential are Malthusian-inspired notions such as 'carrying capacity' of the land for people and livestock. Both these and 'ecopopulist' counter-narratives which emphasise environmental virtues of 'indigenous technical knowledge' (e.g. Chambers *et al.*, 1989), fail to recognise that different environmental outcomes (such as soil erosion and soil conservation) can occur simultaneously as a consequence of social and economic differentiation among small-scale land users (Bernstein and Woodhouse 2006).

A second reason why agricultural innovations based on better natural resource management are problematic is that they often focus on improving the productivity of the natural resource, e.g. land, pasture, trees etc, when the critical criterion may be productivity of labour. Insofar as aggregate data at a regional level can generate accurate analysis, it is worth noting that a comparison of land- and labour-productivity trends in agriculture (1961-2003) in different regions of the world showed the slowest growth in agricultural labour productivity in sub-Saharan Africa, and, uniquely, a declining ratio of land to labour, so that while land productivity was rising, agriculture was becoming more labour intensive (Pardey et al. 2007, 13). In aggregate (and, therefore, not in all specific instances) this has the hallmarks of an 'agricultural involution' with declining labour productivity in agriculture (Geertz 1963). The need for a focus on labour productivity is also suggested by aggregate

productivity data (Table 1) which suggest a much larger African productivity 'deficit' for labour productivity than for land productivity.

Table 1 Comparison of productivity indicators (FAO, 2007)

Region	Value added per worker in agriculture (US$)	Cereal yields (t/ha)
Sub-Saharan Africa	327	1.33
Asia	423	2.80
Lat. America and Caribbean	2966	2.67
Developed Countries	5680	3.92

Agricultural labour and productivity

A focus on labour productivity leads to a number of considerations. Firstly, research on agricultural innovation has typically neglected assessments of labour productivity in favour of land productivity. In the case of green revolution technology, for example, increases in land productivity initially raised labour demand for fertilizer and irrigation management and for harvest. Historically, in east and south Asia, labour requirements were subsequently reduced through mechanisation, as detailed for the more recent case of Bangladesh by Hossain el al. (2007). While the increase in labour input required by the green revolution enabled large increases in output (and hence in labour productivity), this still constituted an additional input and the cost of additional labour may be a factor limiting the adoption of more productive technology. Proponents of agricultural innovation in African agriculture have often assumed that additional 'smallholder' household farm labour has an opportunity cost of zero, so that the poor will benefit from 'labour-intensive innovation'. In practice it is not uncommon for smallholders to suffer labour shortages and/or to supplement family labour with hired labour. Moreover, the timing of additional labour required by innovation may be critical, as also its distribution between household members. The gendered dimension of the intra-household allocation of the burden of such additional labour is exemplified in Carney's work on the introduction of irrigated rice technology in West Africa (Carney 1992).

These considerations apply not only to 'green revolution' forms of agricultural intensification. 'Low external input' technical options may also be rejected or selected according to whether they save labour, irrespective of the effect on land productivity. Labour shortage may, for example, constrain the clearing of woodland regrowth on land left fallow, and favour continuing cultivation of previously cultivated fields, even at the expense of declining land productivity. Work in Kenya shows that labour-intensive approaches to improving land, such as construction of terraces to conserve water and soil on hillsides, which appear to favour the poor because they avoid the need for capital, may nonetheless disadvantage those unable to command labour (Tiffen et al. 1994; Murton 1999). Similarly, work in Malawi suggests that labour-intensive 'Integrated Pest Management' (IPM) approaches to pest control, which

reduce the need to purchase pesticides, have only been adopted where farmers are already spending significant sums on pesticides to protect a high value crop, making the returns to the additional labour input worthwhile (Orr 2003).

The question of labour productivity is of particular concern in many African contexts, where labour-land ratios have historically been low and control of labour in extended households has dominated the organisation of production systems (e.g. Haswell 1963; Toulmin 1992). Equally, the development of cash crops historically depended on the ability of rural labour to detach itself from such kinship control and to migrate to other rural areas where forms of sharecropping enabled higher returns (Robertson 1987). In contemporary Africa capitalisation of agriculture is low, and labour shortage remains a widespread constraint in agriculture. As a consequence, labour migration continues to form a key element of agricultural development: zones of high productivity and/or growing market access are frequently sites of immigration, and immigrants' success in profiting from these agricultural opportunities may depend upon their ability both to negotiate access to land with 'native' landholders (see below) and to mobilise labour, sometimes through transnational migrant networks. An example of the latter is the commercial success of Burkinabe migrants growing pineapple in Ivory Coast, attributed to these migrants' advantages in circumventing Ivoirian rural labour shortages by drawing upon labour from Burkina Faso (Chauveau 2006). Conversely, labour emigration (temporary or permanent) may create labour shortages, even in areas with population densities as high as 1000 people/km^2, such as western Kenya (Place et al. 2007, 155) making labour shortage a binding constraint for farming innovation for households too poor to hire in the extra labour needed. Recognition of this labour constraint undermines 'small farmer' models that rely upon raising farm productivity through labour-intensive innovation, except insofar as those models recognise also small farmers' unequal command over labour and the consequent socio-economic differentiation associated with labour investment to raise productivity.

The observations in the preceding paragraph suggest that there are difficulties with concepts of reducing poverty through agriculture where these rely on raising farm productivity either through capital-intensive ('green revolution') or labour-intensive models focussed on individual farm households. It suggest that, if the poor are to benefit from agricultural innovation, more attention may need to be paid to investment in 'public goods' that reduce risk in agriculture. Successful examples in the African context would include the control of the cassava mealybug pest by the introduction from South America of a natural predator, a species of parasitoid wasp. As Orr (2003) has observed, contrary to prevailing discourse, this successful 'integrated pest management' programme required no farmer participation but significantly reduced a major threat to a basic staple crop through the agency of (internationally-funded) government action. Similarly, if it is possible to identify a single investment with widespread impact on agricultural productivity in Africa, it is likely to be improved water control, extending from large-scale irrigation to small-scale stream diversions, water harvesting, and managing watershed vegetation cover. The vulnerability of much of sub-Saharan Africa's agriculture to failure is largely due to rainfall variability, but also to the fact that it has a very low level of usage (2-3%) of its water resources. For comparison, South Asia, with double the population and only two-thirds as much water is using 25-35% of its available resource. There is evidence that good access to markets can prompt private investment to develop water

management, including in areas previously considered marginal for agriculture (Tiffen et al. 1994; Southgate and Hulme 2000; Woodhouse et al 2000), but in many instances effective management of water will require coordination at scales beyond the individual farm.

Stated in aggregate terms, African agricultural productivity would appear to be greatly improved by investment in water resource development, and South Africa's commercial agriculture is largely based on this principle. Here we find ourselves in the realm of 'infrastructure, markets and supporting institutions', rather than 'ecological complexity'. It is a terrain replete with examples of negative impacts on the rural population, for example though displacement from sites of dam reservoirs and disruption of existing production by changes in river flow, exemplified by Adams' (2000) analysis of the impact of the dams constructed in the late 1980s in the Senegal River Valley. A more positive outcome is exemplified by Aw and Diemer's (2005) account of large-scale irrigation on the Niger river in Mali. As would be anticipated from the earlier discussion of labour mobility in Africa, development of water resources that leads to improved agricultural opportunities (which presupposes growth in demand for agricultural output) is invariably characterised by immigration from less productive rural areas, and increasing competition for land, typically involving the development of informal land markets (Robertson 1987; Woodhouse 2003; Peters and Kambewa 2007). Unresolved questions of the status of customary or 'community' land rights in contexts of increasingly commoditised land use are central to determining the effect of these developments – both small and large scale – on poverty (Chimhowu and Woodhouse 2006). One important consequence is that poverty cannot simply be mapped on to geographically-defined areas of 'high' or 'low' agricultural potential, or in terms of 'remoteness'. While the proportion of poor (in terms of poverty incidence) may be higher in less accessible rural areas, the overall number of poor in absolute terms (the 'poverty density') is typically higher in more accessible areas. Moreover, 'there is no clear pattern among countries for the distribution of poor population and agricultural potential' (World Bank, 2007: 49). This underlines the importance of political strategies, of reform and administration of property rights and employment conditions, and of provision of technical support, that are integral to water development. More generally, the discussion of agricultural productivity improvement through technical development purely in terms of an 'agricultural sector' – typically envisioned in terms of 'small farms' – neglects important linkages with the wider economy that are articulated through markets for labour and other resources.

Linking agricultural productivity to the wider economy.

The particular importance attributed to agriculture in reducing poverty rests on the observation that 'three of every four poor people in developing countries live in rural areas' (World Bank,2007: 1), and the argument that 'Agriculture alone will not be enough to massively reduce poverty, but it has proven uniquely powerful for that task.' (*ibid,* 1). It is important, however, that these arguments are not used, as they tend to be in publications by international agencies, to treat the rural economy as separate from the urban, or regional ones (see for example IFAD, 2001 and World Bank, 2007). The recent *World Development Report 2008* represents a particularly extreme case in which, of three 'worlds' (or scenarios) of agriculture it identifies: one is an economy that is agriculture-based, a second is 'transforming' through industrialisation and urbanisation, and a third is 'urbanised'. In this framework

policy emphasis shifts from agricultural productivity as a basis of economic growth in 'agriculture based' economies, to raising incomes by specialising agriculture or diversifying employment out of agriculture in 'transforming' economies, to addressing the environmental impacts of intensive agriculture in 'urbanized' economies. There is a clearly an implicit linear model of economic development in the definition of these 'agricultural worlds', and the identification of large geographical regions with a single 'agricultural world' inevitably raises questions as to accuracy and credibility. Thus, Sub-Saharan Africa is characterized as 'agriculture-based', while 'transforming' countries include 'most of South and East Asia and the Middle East and North Africa', and 'urbanised' countries include 'most of Latin America and much of Europe and Central Asia'. One difficulty with such a framework is that 'placing agriculture at the centre of the development agenda' for 'agriculture-based' Sub-Saharan Africa effects a disconnection of agriculture from urban Africa, and the flows of labour, capital and agricultural products between 'rural' and 'urban' parts of the economy. Instead, a rural economy is envisaged as constituted by 'smallholder farming' held back by low productivity.

In this view agricultural development is a precursor to industrialisation, but via development of the *rural* economy: increasing (small-scale) farm productivity generates higher incomes for producers and lower food prices for consumers, and the increasing purchasing power of agricultural producers is a stimulus to the non-farm rural economy providing goods and services to agricultural producers. In practice, this model of 'supply-driven' growth of the rural economy resulting from growth in agriculture gives insufficient emphasis to the non-agricultural economy, even in Africa, where some 38% of the continent's population lived in urban areas in 2001, a figure projected to rise to 46% by 2015 (UNCHS 2001, 271). In many parts of sub-Saharan Africa (Botswana, Côte d'Ivoire, Nigeria, Senegal, Cameroon, and Congo) more than 45% of the population was already classified as urban in 2001. The significance of this urban economy is reflected in the low share of GDP generated by agriculture – no more than a third and typically a fifth – in sub-Saharan Africa's 'agriculture- based' economies (World Bank, 2007: 340-1). It is entirely consistent that non-farm income is often a major element in African rural livelihoods (Reardon, 1997; 1998; Bryceson, 1999, 2002; Barrett et al. 2001; Ellis 2000; Ellis and Freeman 2005), even in rural economies, such as that in northern Mozambique (Tschirley and Benfica, 2001), where the role of non-farm income in rural economy is not immediately apparent. Moreover, where financial services are poorly developed (i.e. almost everywhere in sub-Saharan Africa) such non-farm income is the main source of investment for raising farm productivity (Collier and Lal 1986; Evans and Ngau 1991, Reardon 1998; Lanjouw and Lanjouw 2001). This may be further exemplified by the patterns of agricultural investment by migrant mine labourers in southern Africa (First 1983), and in the funding of construction of hillside terraces for agriculture in Machakos District (Kenya) from income and credit derived from employment in Nairobi (Tiffen and Mortimore 1994; Murton 1999). Equally, such studies suggest that rural households' unequal access to remittances and income from non-agricultural employment 'will lead over time to an increasingly skewed distribution of land and other assets in rural Africa' (Reardon 1997, 743). The role of non-local income sources in establishing large differences in household incomes in cotton-growing areas of northern Mozambique is also identified by Tschirley and Benfica (2001).

At the level of the broader national economy, the key point here is that expansion of the non-agricultural - urban and industrial - economy is critical for the increase in demand for, and investment in, agricultural output. Urban-industrial factors tend to be downplayed by 'linear' models of development. Thus: 'rapid agricultural growth in China, India, and Vietnam was the precursor to the rise of industry' (World Bank, 2007: 7), implying that agricultural growth occurred in the absence of industrialisation. Historical accounts suggest the opposite, however: that agricultural productivity growth has been dependent on industrial development for the supply of key inputs - notably fertilizer – as exemplified by Hayami and Ruttan's (1985, 235-6) review of agricultural intensification in 19th century Japan, or Geertz's (1963) comparison of rice production in Java and Japan. This point is further reinforced by the observation (World Bank, 2007: 166) of current acute underfunding of agricultural research and development in developing countries - except in the industrializing economies of China, India and Brazil.

A final question arises concerning the role of markets in promoting agricultural productivity growth. While it is clear that access to demand from urban and/or regional markets is a fundamental requirement for investment in improved agricultural productivity, I have suggested above that private investment may be insufficient if agriculture is to provide a broader base of poverty reduction. In this respect, the prevailing policy prescriptions need to be re-examined. While acknowledging widespread market failure in 'agriculture-based' economies, particularly in input supply, credit, and research and innovation, there remains a strong presumption among many international funding institution of not only the desirability, but also the feasibility, of making such markets work to the benefit of the poor. However, what characterises much of this discussion is the dependence of specific markets upon the 'efficient' operation of other markets. For example "Land market policies can become less effective if there are wealth-biased financial market constraints." (World Bank, 2007: 144). More often, however, the commitment to rural poverty reduction via market mechanisms appears to skirt around contradictions. Thus, 'dynamic commercial input markets' in Asia and Latin America are declared the result of 'complementary investment' in roads, irrigation, marketing infrastructure and financial services, and the absence of these in Africa is held to explain the weakness of commercial input supply (p. 150). It is not stated where this 'complementary investment' is to come from, though it seems that some form of public funding is implied.

Similar conditions apply to new approaches to establish private-sector-led input distribution systems, which in practice rely heavily on state expenditure and/or improved farmer organisation. The difficulties of considering this a strategy *primarily* concerned with the very poor is exemplified by Uganda's Plan for the Modernisation of Agriculture (PMA) which includes elements of infrastructure (road) investment and a 'demand-led' agricultural advisory service (NAADS). The latter envisaged the formation of farmers groups who would constitute 'demand' for agricultural technical services to be supplied by a private sector created by 'delayering' the existing government agricultural extension system. Analysis of the implementation of this process (Bahiigwa et al, 2005) suggests that it is not the poor, but better-off farmers who are most likely to benefit due to both their organisational capacity and political influence at local level, and central government officials' priority of raising aggregate production by supporting those farmers most capable of 'achieving results'.

The commitment to finding market mechanisms to allocate resources to those without purchasing power involves assumptions that appear inconsistent with empirical experience and increasingly require complex semantics that raise questions about the dividing line between 'subsidy' and 'complementary investment'. One evident assumption of such approaches to rural poverty reduction is that 'the poor' have command of land and labour that will enable them to take advantage of agricultural inputs. It is often the case, however, especially in those rural areas (with good accessibility and high rates of immigration) with large numbers of poor, that the poorest have very little land and earn much of their living from rural employment in agriculture or a variety of other low-paid natural resource-based work (fishing, herding livestock, wood-cutting etc.) (Barrett et al. 2001; Start 2001). Yet, as the World Bank (2007: 221) observes, 'stunningly little policy attention has been given to the structure, conduct, and performance of rural labour markets'. Recent survey work in Zambezia (Cramer et al, 2008) suggests that rural labour markets are an important source of income for rural households but are highly 'segmented', reflecting employers' ability to determine a wide variety of wage rates and employment conditions, with obvious implications for income levels and rural poverty.

Conclusions:

This paper has argued that there are flaws in much of the prevailing approach to reducing rural poverty through 'agriculture-based' interventions, most comprehensively set out in the World Bank's *World Development Report 2008*. In reviewing the prospects of increased productivity as a result of technological change, I have suggested that the potential of new technology has yet to be thoroughly explored, but that reductions in poverty are unlikely to be delivered by new technology unless there is a clearer understanding of the social and economic context in which the 'rural poor' live. This does not amount to an argument against intervention to improve living standards of the rural poor. Rather, it is an argument that attempting to do so within an 'agriculture-based' rural economy, largely divorced from, on the one hand, employment and other markets of the urban and industrial economy, and on the other hand from explicit non-market state investment, has the effect of narrowing the range of possible 'investment opportunities' seeking to contribute to a 'productivity revolution in smallholder farming.'

The paper suggests four main areas in which research needs to take a new approach to investigating the constraints to agricultural productivity improvement, and the relationship of these to rural poverty. Firstly, any expectation of increased investment and productivity growth has to be founded upon a realistic assessment of the existing and potential stimulus to agriculture from urban markets and regional markets. In the absence of access to strong (urban) market demand it is unlikely that agricultural investment will take place, productivity will remain low and rural areas are likely to suffer a loss of labour to temporary or permanent emigration, further reducing productive capacity and increasing impoverishment of those remaining on the land. Secondly, the relationship between private investment in agriculture and investment in 'public goods' needs to be more explicitly addressed, and, in particular, the scope for risk-reducing public investment needs to be assessed, for example in the field of water management (e.g. water conservation, drainage, or irrigation) and pest control (e.g. direct control of disease or dissemination of pest-resistant seed and planting material). Thirdly, rather than envisioning a homogeneous rural society of 'small-

scale farmers', research needs to characterise more clearly the different categories of farmers and the labour relations among them, and between them and the wider economy. Finally, bearing in mind the socio-economic diversity within rural society, research is needed to chart the social and political impact of increasing productivity and profitability of farming. Greater recognition of labour mobility and the consequent immigration of people to areas where agriculture is more profitable will enable research to illuminate processes governing the evolution of labour relations and competition for land, and provide a clearer understanding of social change on which to base intervention to reduce poverty.

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