

The Contributions of Agriculture to Economic Transformation: The Case of Tanzania

ANDREW COULSON¹

1. INTRODUCTION

Agriculture contributes to economic transformation in many ways. The four most important are the following:

1. It feeds the population – both those who live in rural areas and rapidly increasing numbers who live in towns and cities.
2. It earns foreign exchange. This assumes that surpluses are produced for which there are viable markets overseas.
3. It provides markets for the products of manufacturing industries and services. Because very large numbers of purchasers may be involved, and large quantities may be produced, these industries and services may be efficient, and able to export externally, e.g. to neighbouring countries.
4. It provides or contributes to employment for approximately 70% of Tanzania's population that continue to live in rural areas. Figure 1 shows how, though town and cities are growing fast, the absolute numbers living in the rural areas are expected to continue rising for at least another 20 years, after which it may stabilise or very slowly decline. Either way very large numbers of people and families are involved. In this sense agriculture may be described as a "sponge" (Kilama and Wuyts) or "reserve army of labour" (Karl Marx) which can keep labour gainfully employed until it is needed in urban areas.

In Tanzania now, the first of these is by far the most important. The country is close to self-sufficiency in food. In recent years it has exported maize. It is close to meeting its needs for rice. However, is highly unlikely that Tanzania can be self-sufficient in wheat – and imports have been encouraged by the construction of extremely modern importing and processing facilities in Dar es Salaam (in passing, there is a case for an import duty of

wheat). In addition, Tanzanians eat many other foods – bananas, cassava, sweet and round potatoes, beans, and almost every possible fruit and vegetable, most in increasing quantities in recent years, and nearly all grown locally. One of the mistakes being made in several recent policy documents is to concentrate far too much on just a few crops (for example the Agricultural Lab of Big Results Now puts all its emphasis on maize, sugar and rice).

Earning foreign exchange from agriculture is less important than it was – though of course foreign currency is always welcome. This is partly because Tanzania now sells minerals and gas, but also the calculations of investors and the generosity of donors – including American and other international companies at the one extreme, and China at the other, together with historically low interest rates internationally – mean that investment projects can be financed externally.

The third, the creation of dynamic markets for local produced products of manufacturing industries, is happening already. Exports of manufactured goods are now about equal to exports of agricultural products. For transformation to occur, it needs to grow more and faster. For those who use the term, the creation of a dynamic and efficient manufacturing sector is the key to economic transformation.

The fourth, agriculture as a sponge keeping alive large numbers of people until they (or their children) can be employed elsewhere is self-evident. The chart below shows the dynamics of population growth in Tanzania. Figure 1 shows the population growing at a little under 3% per annum. The percentage living in urban areas is about 30% now, and will reach 50% around 2045. For at least another generation the majority of an

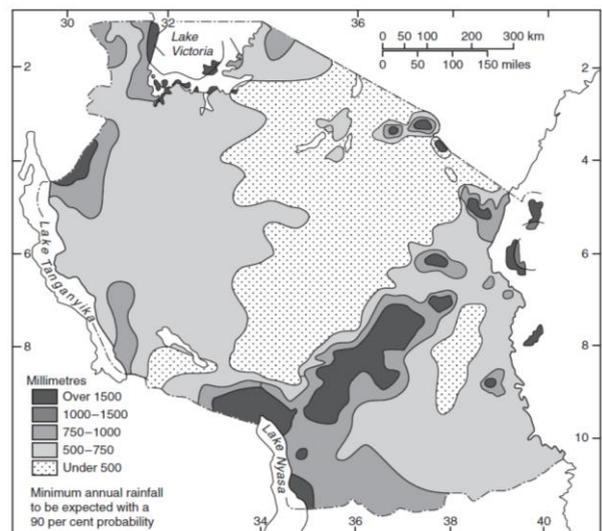
expanding population, and more in total than now, will live in rural areas. A dynamic, and labour intensive, agriculture is essential to keep them in employment.

**2. SOME MYTHS AND MISUNDERSTANDINGS:
CLEARING THE DECKS**

1. **The term “peasant” is best avoided.** In common English usage a peasant is uneducated or stupid. But there is overwhelming evidence that small family farmers in Africa and Asia respond to price incentives, and take decisions about what to plant, when to plant, how to plant and weed, and what to sell, which are conscious, rational, and entirely justifiable in their terms, bearing in mind that they must avoid risks – the risks of not growing sufficient food to feed their families and hence having to buy food when prices are high, or of getting into debt and not being able to repay loans. They reduce risk by growing a wide range of crops, planting them at different times, and often more than one crop in the same field (inter-cropping). These are all techniques which have been explained and justified by agricultural economists who have studied small farms. It has also been shown, not least in Tanzania, that small farmers can successfully undertake complex agricultural processes, including many where it was earlier alleged that they would not be capable (a good example is the curing of tobacco). Those who criticise small farmers should be aware that there are many studies, from almost all parts of the world, which show, in particular places, average yields on small farms higher than those on large farms.

2. **Tanzania does not have large areas of land which are available for agriculture.** In many parts of Northern Tanzania almost all suitable land is in use, much of it continuously (when the land would benefit from years of fallow, say one year in four). About a quarter of Tanzania’s total land area is allocated to

national parks, game reserves, forests or swamps. Increasing areas of good quality land are being built on in urban areas. The map below shows that nearly a third of Tanzania’s land area has average expected rainfall of less than 500mm per year. Below this level, tropical agriculture is extremely risky, not least when much of this rain falls in heavy storms at times which are not accurately predicted. The situation is worsened because the quality of the soils is poor – they often lack nutrients, and organic matter is destroyed by the hot sun, meaning that the soil does not retain water for long. This land is better used for extensive grazing or ranching. Many definitions of “arable land” do not take account of rainfall. This claims such as “.....” should be treated with extreme caution, or avoided.



Map 3 Rainfall probability
Source: Len Berry (ed.) *Tanzania in Maps*, University of London Press, 1971.

3. **The potential for large scale irrigation is not high.** Most of the countries which have very large rivers drain massive snow-covered mountain ranges such as the Himalayas, Andes, or Rockies. Most of the rivers in Tanzania are relatively small. There are many pressures on them – not least human consumption in the rapidly expanding cities and the generation of hydroelectricity. Where weirs have been built to divert flows for irrigation, several of these rivers have become seasonal or

dried up in some years (e.g. the Pangani and Great Ruaha rivers). The expenses of large-scale irrigation can be justified if more than one crop a year can be grown. But on many rivers, such as the Wami discussed in the case study of Dakawa below, there is insufficient water in the rivers in the dry seasons, when water for irrigation is needed if two crops are to be grown. In many parts of Tanzania soils are sandy and allow water to drain quickly, but the aquifers are very deep down, making the construction of boreholes expensive and the results difficult to predict. In the medium or long term, there is a risk that some of the large swamps dry out – this would further deplete dry season flows. Water levels in Lakes Tanganyika and Victoria are falling – there is even a possibility that Lake Victoria, a relatively shallow lake, could be reduced to a small fraction of its present size or dry up entirely, with drastic consequences for the settlements around the lake.

4. **Statistics are unreliable.** Official figures show % of GDP coming from “non-marketed agriculture” and % from “marketed agriculture”. In recent years, Tanzania has made great efforts to improve its agricultural statistics. But the problems are daunting. Liberalisation has meant that increasing quantities pass through unofficial channels (e.g. coffee illegally exported to Kenya). There are problems pricing non-marketed production – e.g. are higher prices included for produce sold stored and sold later, and how are crops valued when they are grown and then there is no market (as happened when the crop of cashew nuts in 2011 exceeded the capacity of local processing, and much of it missed the opening for export for processing in India). It is also difficult to calculate yields when small quantities of a crop are grown on a farm, mixed with other crops. National figures for yields from small farms should be treated with great caution.

3. AGRICULTURAL STRATEGIES

Tanzania has many strategies. The *Tanzanian Development Vision 2025*, launched in 1999 and still in many planners’ and politicians’ thinking, aims to transform the country in 25 years “from a low productivity agricultural economy to a semi-industrialized one, led by modernized and highly productive agricultural activities which are effectively integrated and buttressed by supportive industrial and service activities in the rural and urban areas.” Its thinking was developed in *MKUKUTA*, the National Strategy for Growth and Reduction of Poverty, prepared in 2005 and revised in 2010. This is the strategy to reduce poverty and inequality, primarily in the rural areas, and to meet targets of the UN’s Millennium Development Goals.

The *Five Year Development Plan 2011/2012-2015/2016*, was launched in 2012 and provided detailed financial estimates and projections to support the goals of MKUKUTA. A further Five Year Plan, to start in 2016/2017 is being prepared. A Human Development Report, funded by UNDP and published in 2015 set out to show what was needed to produce “economic transformation for human development”.

Detailed proposals for agriculture were set out in the *Agriculture Sector Development Programme (ASDP)* which covered the period 2006-2013, and attempted to make operational the proposals of the *Agriculture Sector Development Strategy* of 2001 – prepared in the heyday of liberalisation. The ASDP took a long time to develop, not least because it was “basket funded” by a consortium of external donors who found it hard to form a consensus on what should be included. ¹ In 2005, when the ASDP was in its

¹ Basket funding meant that the consortium agreed on the projects, and agreed to fund a high proportion of their costs, and to monitor their implementation. The ASDP basket was funded by the World Bank, African Development Bank, IFAD, the European Union, and Japan. Other donors, including DfID, dropped out during the negotiations. One of the problems in the implementation was that the Government of Tanzania found it hard to

final stages of preparation, and in the run up to a Presidential election, the Government made very large commitments to irrigation. This led to almost 80% of the money in the ASDP being allocated for irrigation (Therkeldsen 2011, pp.14-21; Coulson 2015). At the time of writing a further ASDP is being prepared.

Kilimo Kwanza ["Agriculture First"] can be seen as a reaction, or correction, to some aspects of the ASDP. It was prepared, in 2009, by two organisations which represent large farmers, the Tanzania National Business Council and the Agricultural Council of Tanzania. It comprises broad-brush policies, set out in ten "pillars" (Government of Tanzania 2009). The opportunities opened up for large scale agriculture were much more overt than in any previous Tanzanian document. In particular, Pillar 5 strengthens the power of the state to allocate land for large scale agriculture. Pillar 2 committed the country to substantially increased spending on agriculture, and especially on irrigation, so meeting the Maputo Declaration target that 10% of the Government budget be spent on agriculture, and to creating a Tanzania Agricultural Development Bank, among other measures.

The Southern Agricultural Growth Corridor of Tanzania (SAGCOT) was developed by the British consultants AgDevCo, with support from the Norwegian fertilizer producer Yara International and a range of powerful international organisations and donors. It was launched in Dar es Salaam and then at the World Economic Forum in Davos, Switzerland, in 2010. Its website describes it as "an inclusive, multi-stakeholder partnership to rapidly develop the region's agricultural potential."

It covers more than a quarter of Tanzania's land area – from Dar es Salaam and Kilwa on the coast across to Lakes Tanganyika, Rukwa and Nyasa, including almost the whole

catchments of the Rufiji, Wami Ruvu and Malagarasi rivers – not a "corridor" in the normal use of the word.

Much of its publicity is aimed at attracting agri-businesses to invest in large farms. But it also promotes the benefits of small farmer "outgrowers", who grow crops on contract to supplement those produced on a central farm. In the early years development was very slow, not least due to problems getting access to suitable land. More has been achieved recently, not least because both USAID and DFID have supported SAGCOT projects.

Big Results Now, from 2011, used the Malaysian "delivery lab" approach to planning, in which stakeholders in relevant sectors were closeted in a hotel for 2-3 weeks until they had agreed an action plan for their sector. Agriculture was one of six "labs". The targets for agriculture concentrated on just three crops: maize, rice and sugar. (It was left open for oilseeds and horticultural crops to be added in a second phase). There were to be irrigated "25 commercial farming deals" for rice and paddy – 11 of these would include "nuclear farms" of 20,000 hectares or more with substantial extra land for outgrowers – and 78 smaller "collective rice irrigation and marketing schemes", where land is prepared and irrigated collectively, but cultivated individually. The maize sector would be addressed through 275 Warehouse Receipt Schemes.

The development economist Brian van Arkadie, who has written extensively about Vietnam, commented at the 2013 REPOA Workshop that this type of planning linked with administration, which has been successful in creating industrialisation in many Asian countries, derives from the military – and often uses the same kind of command centres, charts and maps. However, when applied to agriculture there is too much detail and uncertainty for models of this sort to guarantee success. That appears to have been the case for many of the large-scale proposals, and, only 5 years after its launch,

meet its obligations, especially the large components of recurrent funding delegated to the district councils.

not a great deal is now heard of the agricultural components of Big Results Now.

4. THE DEBATE ABOUT TRANSFORMATION AND THE ROLE OF AGRICULTURE IN TANZANIA

Economic transformation is a fashionable way of approaching the problems of development. In most recent formulations it is a way of asserting that processes of industrialisation, and their relationships to other sectors such as agriculture and services, are essential if large populations are to come out of poverty. It is hard to call this original, or in doubt. Since the Soviet Union industrialised in the 1920s and 1930s it has been widely understood that development was usually about industrialisation – and, arguably, they were only catching up with what Britain, Germany and Japan had done before them. In the recent formulations it is often asserted that labour must be transferred from agriculture to industry. But in terms of economic history that is increasingly questioned: Japan and Southern parts of Germany such as Bavaria kept many small farms, while many economic historians now conclude that Britain (probably) and the Soviet Union (for sure) could have

scale agriculture rather than forcing people off the land through enclosures and state farming.

However, it remains at least a good working assumption that any country with a seven-figure population and lacking great wealth from oil, gas or minerals, will need to industrialise to take its people out of poverty. With this assumption, it is fair to ask what should be the role of the state towards agriculture and rural development.

The discourse about structural transformation easily morphs into a conclusion that small-scale agriculture has failed. This is often expressed in terms of productivity: that small scale producers are unable to produce the yields obtained by large farms. Yet in countries such as Tanzania, from around the time of liberalisation in 2000-2001, agricultural production in GDP figures has grown at around 4% per annum, faster than population, and a very respectable achievement over a long period not matched by many countries. This was achieved at a time when world markets for several of Tanzania’s “traditional” agricultural export crops were depressed – notably coffee, cotton,

	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/1	2011/2 *
Food crops:											
Maize	2,705	2,322	3,157	3,219	3,373	3,302	3,594	3,556	4,733	4,123	5,240
Rice	640	713	688	759	784	872	897	875	1,723	1,439	1,128
Wheat	77	74	67	102	110	83	86	92	62	113	103
Export crops:											
Cotton	49.9	63.4	46.9	114.6	125.6	43.8	67.3	123.6	89.5	54.8	75.7
Cashewnuts	67.3	95.0	79.0	72.0	77.4	92.6	99.1	79.1	75.4	121.1	158.4
Coffee	37.5	52.4	32.5	54.0	34.3	54.8	43.1	68.5	34.6	56.8	33.5
Tea	24.7	27.6	30.1	30.7	30.3	31.3	32.7	31.6	32.1	35.0	35.8
Tobacco	28.0	28.0	34.0	47.0	52.0	50.7	50.8	55.4	60.7	94.2	126.6

Production of Major Agricultural Crops, Tanzania Mainland 000' Tonnes

Source: Bank of Tanzania Quarterly Economic Bulletin, June 2012, Table 1.11

industrialised faster and avoided much of the misery inflicted on their people in both rural and urban areas if they had promoted small

sisal, and to a lesser extent tea. The growth has largely been based on maize, rice, potatoes and a wide variety of fruits and

vegetables. Yields may have been low (though the statistics on yields are not reliable) but the surpluses were real.

It is well known that the innovations of the green revolutions – improved (often hybrid) seeds, fertilizers, insecticides and other chemicals – are in broad terms scale-neutral. They can be adopted by small farmers as well as large. The problems are logistical: to get the new seeds and inputs to where they are needed, to ensure that markets deliver fair prices, and that crops that are grown and put up for sale are purchased.

The availability of inputs was achieved in Tanzania, and in nearby countries such as Malawi and Zimbabwe, by supplying inputs free or at low cost. Some of these inputs have been sold by smaller to larger farmers, and some have been used on crops other than those for which they were supplied. Neither of these is necessarily bad: what matters is that the inputs are used.

There are much greater problems with the marketing. It is a major exercise to move ten thousand tonnes of maize from (say) Rukwa to Dar es Salaam – though improved roads make it easier than it was. Very large crops of cotton or cashew nuts may need to be processed or sold quickly, to get the benefits in terms of prices from being grown in the Southern hemisphere. On a number of occasions, the price of rice was unexpectedly depressed by unexpected large imports of cheap rice – causing problems to the cash flows of large irrigated farms and small farms in the valley bottom alike (this affected both Dakawa and Mngeta Rice farms, discussed below). If warehouse receipt schemes are not well run, so that poor quality or wet crop depresses the value of better quality crop, then farmers may not be paid what they expect. There are also problems if there is lack of competition between traders, or collusion – so that farmers get paid for less than they sell.

If markets are not secure, all farmers, but especially small farmers, will be extremely

careful in the risks they run. They will plant small quantities of different crops, they will plant at different times, and they will be extremely reluctant to take on credit which they may not be able to repay. They will first ensure their food supply for the forthcoming months. The biggest single action the state can take is then to ensure that information about fair prices is available (e.g. through mobile phones), that traders have the cash to buy the crops that are offered for sale, and that the details in contracts between growers and suppliers are maintained by both parties, especially with regard to quality.

In the 1980s and 1990s, as Tanzania came to terms with structural adjustment and then liberalisation, its markets for agricultural products were disrupted by low prices. At this time, much of the writing about agriculture was defeatist – with terms such as “depeasantisation” or “deagrarianisation” and discussions of the challenges facing agriculture. In African countries North of Tanzania where the Sahara Desert is spreading South, these are real, and there are parts of Tanzania where climate change is having an adverse impact. But overall in Tanzania, and especially in the Southern half of Tanzania, the rains in recent years have been good and agriculture has flourished.

The loss of confidence in small farmers coincided with food shortages in world markets, and a short-lived belief that it was good economics to grow crops and turn them into fuel. This led to large agri-business and chemical companies, and smaller opportunistic capitalist entrepreneurs taking a strong interest in large scale farming in Africa. The results have generally been disappointing – it appears that most of the large farms where land transfers to foreign interests were approved for them to grow biofuels have failed. The costs of investment, the logistical challenges, the difficulties of employing and managing large labour forces, and the uncertainties of markets and marketing, have all proved difficult for large farms. That does not mean that they have no role or future.

There are certain crops, wheat for example, or sisal, where growing is likely to be efficient, if at all, on large farms. Also, the supply of flowers for international markets, where quality and transport arrangements have to be near perfect. Or the multiplication of seeds, where quality has to be kept under constant control. Tanzania has a history of large farms co-existing with small farms that goes back to the Germans more than 100 years ago, and there is no reason to think that this will not continue.

There are still many uncertainties. It is argued that a large proportion of marketed agricultural production comes from farms whose size is above average. This may well be so, but the fact that a farm family are themselves fed and clothed is not without benefit to the national economy. The conclusions that policy should support larger "progressive farmers" were explicit in the five-year plans prepared after Independence 50 years ago; they were controversial then as they are now. But it is significant that very large Tanzanian-owned farms have not widely developed, although clearly some exist, even in parts of the country where land is readily available. This suggests that it is not so easy to make big money out of large scale agricultural production.

The excessive concentration of agricultural budgets on large scale irrigation has already been noted.

It needs to be recognised that agriculture takes goodness out of soils, and this has to be replaced, by one means or another. This can be done by green manure, either placed in the soil, or allowed to enter the soil during fallow periods. Some crops, such as beans and other legumes, improve the soil. But often under Tanzanian conditions it will be hard to maintain yields over long periods without the use of fertilizers.

Women continue to carry out much of the heaviest labour in agriculture, and often not to share fully in the returns. Thus, interviews with women farmers show that often when

crops are sold it is men who get the money and they may not share it with the women who have done much of the work. There are issues relating to land ownership, especially when women are widowed or divorced: the new constitution for Tanzania proposed by the Warioba Commission would have strengthened the rights of women to inherit and get title to land.

5. CONCLUSIONS FOR DONORS

There is no reason to doubt that levels of increase in agricultural production that have been seen in the last 15 years or so can continue, and that there will be markets for food grains in neighbouring countries or overseas if Tanzania produces surpluses. Most of this production has come from small, or smaller, farms, and there is no unsurmountable reason why this should not continue.

The key is marketing. It requires either a single channel of marketing, in which a farmer has just one outlet for the crop, e.g. a local processing factory, or ginnery, and where prices are maintained. The purchasing agency may also organise credit for inputs, either to individual farmers or to "farmer groups" or primary cooperative societies. This system, sometimes called contract farming, has been the basis of small-scale tobacco and tea cultivation since the 1970s, and has been attempted with other crops, with mixed success. It requires an absence of corruption, very strong regulation to ensure that contracts are adhered to by both contracting parties, and fair prices if possible advertised in advance.

Donors should have more belief in market forces. If there is a market for a crop, planting material and other inputs are available, and some farmers in an area are growing it, it is likely that others will follow, as happened with round potatoes – see the case study below. There is no need for extension work in such cases, and extension workers may be inexperienced, unduly rigid, and unable to adapt their recommendations to local

circumstances. If they use force, then it should be for short periods, not more than two seasons, and after that farmers should have the opportunity to do things on their own. On the other hand, some practices need to be enforced area-wide – e.g. the burning of diseased cassava leaves, or cotton bushes at the end of a season to lessen outbreaks of disease the following season.

Information can be supplied in many ways, e.g. mobile phones, radio programmes and interviews, and by short intensive courses for farmers.

Seed laws which make it difficult for farmers to share seeds or improve local varieties should not be rigorously enforced. Over-reliance on a small number of varieties will leave the country vulnerable to any diseases which attack these varieties. It also risks losing the biodiversity on which, in the long term, agriculture depends, as well as many local properties attractive to Tanzanian women, such as the texture of a crop, its aroma in cooking, colour, and taste (“Kyela” rice for example).

Tanzania has invested heavily in tarmacking its network of trunk roads. It is time now to invest much more in feeder roads, in order to be able to move crops from remote places.

Sudden unexpected imports of agricultural products such as rice and sugar can be extremely damaging to farmers, large and small

As argued above, large farms have a role. But this should not be exaggerated. Normally a large farm should have the collateral to borrow money for investment (with the farm itself providing the security), so donor money should not be needed to support large farms.

Overall the keys to transformation are infrastructure, manufacturing, and skills training. But as we have seen many of these relate to agriculture. For example, industrial production of agricultural machines or chemicals (backward linkages). Or agriculture

as a provider of feedstocks to local factories (forward linkages). Or jobs in storage, transport, market intelligence, marketing, inspection, export, and any other parts of the value chains. Training needs to be flexible and responsive – teaching farmers and extension workers how to express their problems and how to find solutions to them (as distinct from delivering a set of “messages” and enforcing these by force or contracts).

APPENDIX: CASE STUDIES OF AGRICULTURAL TRANSFORMATION IN TANZANIA

1. Potatoes in Njombe

Round (or Irish) potatoes in the Southern Highlands are a success. But most of that

success is a result of farmers' initiatives and opportunities, with some involvement of researchers at Uyole Research Station.

An anthropological study published in 1996 tells the stories of three farmers who were migrant labourers in the Arusha and West Kilimanjaro areas where they worked on farms that grew potatoes.² Some of these they brought back to the Southern Highlands and planted them, in one case as early as 1961, and they grew well. 15 varieties of potatoes being grown in the area in the 1990s were imported in this way. These were varieties originally bred in Kenya with resistance to blight. Several of these varieties are still being grown, completely unofficially, including the red-skinned *irika* variety in the highest areas, and the high-yielding *kagiri* variety, which is suitable for boiling or mashing, in lower areas. When new varieties are introduced in Kenya, they quickly find their way across the border to Tanzania and on to the Southern Highlands.³

The 1996 study related the growing of round potatoes to a number of factors. From the early 1960s, pyrethrum was a profitable cash crop in the highland areas. But its market collapsed in the 1970s, around the time that the road from Mbeya to Dar es Salaam was tarmacked. There were many lorries returning from Malawi or Zambia with spare capacity, so it became cheap to transport potatoes to Dar es Salaam. Then in the 1980s, the production of cassava (nationally) reduced due to infestation by mealy bugs, and in Dar es Salaam chips made from round potatoes partly replaced roasted cassava.

In 1975 a research programme was started at the newly opened Uyole Research Station near Mbeya. Varieties were created that were high yielding and resistant to diseases. Trials were set up on farmers' farms, and six varieties were selected. But the researchers in the

1996 study could not find any farmers who were still growing these varieties.⁴

In 2010 another study found that 58% of a small sample of farmers in a ward near Mbeya were using an improved variety, 80% were using fungicides, and 52% insecticides, and 90% were using the recommended density of planting. 100% were planting at the recommended time. Only 30% (18 farmers) appeared to be using fertilizers. So by this time, the work of the research station and the extension service appeared to be having an impact, though not as great as the researchers would have liked.⁵

The production of potatoes has grown rapidly. The quality is good, and as a result, potatoes are becoming an established part of the diet in cities such as Dar es Salaam. Potatoes are easy to grow, on ridges, on light soil on gentle slopes. A highly successful enterprise has been created and shows no sign of lessening in importance.

This is a green revolution. Research has done its work – much of it in Kenya – and farmers have learnt how to grow the crop, either from extension workers or from other farmers. They select varieties on the basis of a range of factors, and many of the preferred varieties have been introduced by the farmers themselves, largely without assistance from the extension service. These farmers adopt some recommendations (e.g. to use fungicides) more enthusiastically than they adopt others (e.g. use fertilizers). Market forces, and farmer-to-farmer contact, did most of the dissemination.

² Andersson, Jens A "Potato Cultivation in the Uporoto Mountains, Tanzania: An analysis of the social nature of agro-technological change", *African Affairs* Vol. 95 (1996), pp.85-106.

³ Andersson, *op.cit.*, pp.91-2

⁴ Andersson, *op.cit.*, footnote 10, p.87

⁵ Namwata B.M.L, Lwelamira, J and Mzirai, O.B "Adoption of Improved agricultural technologies for Irish potatoes (*Solanum tuberosum*) among farmers in Mbeya Rural district, Tanzania: A case of Ilungu ward", *Journal of Animal & Plant Sciences*. Vol. 8, Issue 1 (2010) pp.927-935.

2. Adaption to Climate Change in Moshi District⁶

Climate change on Mount Kilimanjaro, the nearby Pare Mountains, and the plains below is a reality. It shows up in the rainfall and temperature statistics. Villagers, and officials, are aware of it in their lives: there is less rainfall than there was, and less water in streams and rivers. Seasonality and intensity of rainfall is said by farmers to be changing.

Since 2007 a team of Tanzanians and outsiders has worked in 18 villages in Kilimanjaro Region to understand how farmers, herders and fishers understand this climate change in the broader context of the political, economic, environmental, demographic, technological, administrative, legal and social changes they have experienced over the past 20-30 years, and how they can adapt to it.

These villages vary from settlements high in the mountains grappling with reduced yields of coffee and bananas to areas close to the Ruvu (Pangani) river where pastoral Maasai have learnt to combine their pastoralism with small-scale irrigation.

The key conclusion of this project is that people living locally already have a great store of knowledge relevant to climate change and can co-produce new knowledge in partnership with outside specialists. They are neither 'victims' nor 'villains'. Local knowledge is not just 'traditional' or merely 'indigenous technical knowledge'. Knowledge is also social – about how people work together and interact. For example, women often have concerns and priorities which men do not recognize - knowledge can be a source of

power which they may not always be able to use.

Interaction and exchange via periodic, small markets integrate the highland, midslope area and lowlands. These long-standing arrangements and social-spatial relations encourage food security. In addition, other Food security practices include land preparation sensitive to micro-climates and use a wide variety of agro-climatically suitable crops including rice, millet, sorghum, bananas, cassava and maize. Historically, there were localized food shortages triggered by drought, floods, insect pests and conflict. However, at no time has the whole area suffered from famine, because of agro-climatic diversity.

Forests are huge reservoirs of carbon – some of the forests in northern Tanzania hold more than 400 tonnes per hectare. If these forests are lost, all that carbon will go into the atmosphere and increase the instability and variability of the climate. The forests also supply a great range of foods, medicinal herbs, wood for different purposes, and they protect the springs and water courses.

The state tries to 'adapt' to climate change with large scale engineering mega-projects such as dams and reservoirs, or the creation of game reserves or national parks, and by inviting overseas companies to come to farm huge tracts of land with industrial technology. But this can block the ability of affected farmers and herders to engage in small-scale climate change adaptation based on their local knowledge. Such investments and mega-projects often displaces them, and once displaced they find it more difficult to 'adapt'.

Uncertainty is corrosive. Great grandfathers and grandmothers knew and adapted to climate variability. But today's greater climate variability comes on top of uncertainly caused by changes in government administration, laws governing land tenure and access to water and uncertainty about prices. All this combines to cause anxiety and discourages local innovation and investment. Too much of the discourse about climate change is top

⁶ This note is based on work by Tom Smucker, Edna Wangui, Ben Wisner, Pantaleo Munishi, Adolfo Mascarehas, Charles Bwenge, Gaurav Sinha, Jennifer Olson, Dan Weiner, Eric Lovell and others in the Local Knowledge and Climate Change Adaptation Project (LKCCAP), supported by the US National Science Foundation under Grant No. 0921952. There is more information on the LKCCAP web site <http://tzclimadapt.ohio.edu/>

down, and focuses on small number of crops, uses dodgy data, and ignores the knowledge and creativity of small farmers and herders. One of the ways that small farmers survive is by growing many different crops. Compared with monoculture, this reduces the labour demands at peak periods, but also reduces risks. The results can be seen in the great diversity and variety of food products in any local Tanzanian market.

Many communities and individuals do not have title deeds or clear rights to the land they farm. They need to know where they stand. They do not understand how REDD (an international funding mechanism to pay for Reduction in Emissions from Deforestation and Land Degradation) will work, and whether they will benefit from REDD payments. They are worried that a new water law overrides village control of land. They are worried that there will be nowhere to graze cattle in the dry seasons. Women are very concerned that they have to go farther and farther away to find firewood, while outsiders come and harvest wood, make charcoal, and sell sand – making no payments to the communities who have depended on these assets for centuries.

Pastoralism remains the foundation of livelihoods for most Maasai, but limitations on local forage have coincided with more frequent and severe droughts over the last decade. Maasai engagement in horticulture and maize cultivation in one of the villages studied began after the construction of an irrigation canal in 1974 and has continued to increase through subsequent development of irrigation infrastructure.

Small-scale irrigation farming is identified by many residents as the single most important adaptive practice undertaken in the recent past to lessen the impacts of climate variability. Improved maintenance and expansion of the existing small-scale irrigation infrastructure is central to peoples' aspirations for managing future climate variability.

The state could do more, such as rehabilitation of small-scale irrigation schemes, and by ensuring that every irrigation project includes ditches which return the unused water to the rivers. District administrators can use their contacts to spread information about innovations and good practice. But government policy will have the most impact if it listens to farmers and herders and works with them to find the best innovations which will lessen risk and provide resilience, both when there is too much rain and too little.

3. Outgrowers at Mngeta Farm, Kilombero Valley

The 5000 hectares Mngeta Farm was acquired by Kilombero Plantations Limited, a partnership between the Rufiji Basin Development Authority and the UK-based private company Agrica, in 2008. It is one of the flagship projects of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) and has received support from a wide range of donors including UDAID, DfID, UNDP, and (through its holding in Agrica) Norfund, an investment company owned by the Norwegian Government. Its main crop is rice, and its strategy gives considerable place to outgrowers. This mini-study looks at two contrasting reports of their relationships with their outgrowers – one by the Oakland Institute⁷, the other by a team from Japan led by Yuko Nakano.⁸

The farm was developed by North Koreans in 1986, to grow 2,500 ha. of rice, mostly without irrigation. But the farm went bankrupt in 1993. It was rented out to a private organisation, but this failed to keep up with the rent, and was forced out in 2007. By this

⁷ Mikael Bergius, Anuradha Mittal, Frédéric Mousseau, Arya Tajdin, Dylan Farrell-Bryan, and Brittany Young *Irresponsible Investment: Agrica's Broken Development Model in Tanzania*. The Oakland Institute, Greenpeace and Global Justice Now, 2015.

⁸ Yuko Nakano, Yuki Tanaka and Keijiro Otsuka *Can "Contract Farming" Increase Productivity of Small-Scale Cultivation in A Rain-fed Area in Tanzania?* September 2014

time 150 local farmers had started farming parts of the land.

One of the first tasks of KPL was to recover this land. This required them to pay compensation to the farmers who were occupying parts of it, even though they did not have title to the land. Compensation was paid, both for land and for housing, but the amounts were small and some of the area chosen for resettlement is subject to flooding in the rainy season. The process was contentious at the time and remains so. Many of the farmers who had to move feel that they were much better off before. The Oakland Institute report documents the stories of some very unhappy farmers.

KPL invested in sprinkler irrigation on 215 hectares. This was one of the first uses of this technology in Tanzania, where most of the large-scale irrigation uses gravity. In 2009 it started working with outgrowers; by 2014 more than 6,000 farmers had been trained in new ways of growing rice, and of these about 800 had signed contracts that would give them the improved SARO 5 rice seeds, fertilizers and a hand-held rotary hoe for weeding.

In 2013 DfID made a \$10m loan to KPL, one of its first investments directly into a private agri-business company. Much of this was earmarked for developing the work with the outgrowers.

Turning now to Nakano's paper, this is a study of a sample of the outgrowers who were trained in the new technology. The requirements were rigid. The farmers were shown exactly what to do, by qualified extension workers paid for by KPL, and were not permitted to deviate from this. The main innovations were to plant the new seeds at low density – plants 25cm. apart, in straight lines, and using the fertilizers. Farmers were trained in groups of 25 who had to offer a small plot for the techniques to be demonstrated on, and to grow a small amount on their own farms. The following season they

would quality for the credit, mostly given in the form of seeds and fertilizers.

The results were dramatic. The average yield using the new techniques was over 5 tonnes per hectare. This is nearly double the yield achieved with existing techniques, and more than three times the average yield for rice in Tanzania. It is higher than that achieved on many irrigated farms, and higher than the average yield of about 3 tonnes per hectare which KPL achieves on its own mechanised farm.

There is a downside. The extra production requires more labour, not just to harvest the crop (as would be expected), but in planting and weeding. Even so the calculations in the paper show that the increase in yield would appear to make this very beneficial to the farmers.

There was, however, another problem. The price of rice was difficult to predict because of government policy. The agreement was for the farmers to sell to KPL at a fixed price. But in 2012 the farm-gate price of rice went up, but KPL did not increase the price they paid (meaning that farmers could get more if they sold the rice somewhere else). In 2013, the government banned exports of rice and suddenly permitted imports of cheap rice. The farm-gate price went down and KPL reduced the price it paid the farmers. Farmers were also reluctant to accept the rigid conditions, some, for example, arguing that fertilizer was not needed, or not needed so much, on the rich soils of the Kilombero valley. They were reducing their risks in taking on credit, even if it meant lower overall incomes. The result was that only a few of the farmers who could have taken on the credit actually did so.

These two papers tell us much about the potential for intensifying agricultural production, especially from small farmers, but also the difficulties. The 150 farmers who had occupied parts of the farm when it was not in use created a considerable challenge for KPL. Of the 6,000 who were trained in intensive techniques, and could achieve yields much

higher than the average achieved on the large farm, many chose not to – preferring their independence to choose how to grow their crops and whether or not to get involved in taking on the credit, and the resulting conditions, set out in formal contracts, on how they would grow the improved seeds.

4. Irrigation: Dakawa Rice Farm

This consists of 2,000 hectares of land near the Wami river about 40 km North of Morogoro. In 1981 it was developed by the North Koreans as a mechanised rice farm. The farm is divided into 12 hectare/acre blocks, each of which can be irrigated, using water pumped from the river.

The Koreans left, and the farm, along with other state farms, passed to the National Agricultural and Food Corporation (NAFCO). Following structural adjustment in the 1980s and early 1990s, NAFCO got into financial difficulties, and eventually, in 1996, the company went bankrupt. Promises were made that the land would be made available to small farmers, including some already farming on nearby swamp-land. But in 1999, by which time the land had not been farmed for 10 years, it was instead allocated to 6 large farmers. But their legitimacy was challenged, their titles to the land revoked, and in 2003 the land was passed to UWAWAKUDA, a cooperative, the Ushirika wa Wakulima Wadogo Wadogo Dakawa (Society of Small Farmers in Dakawa) with up to 1,000 member farmers. In 2010, as part of the Agricultural Sector Development Programme, USAID, under its Feed the Future programme, agreed to rehabilitate the scheme. This involved reconditioning the pumps, or replacing them, improving the levelling of the land, and cleaning the irrigation channels.

But there are many problems. In particular, there is not sufficient water in the Wami river in most dry seasons for it to be extracted. This appears to be a consequence of illegal abstraction upstream, combined with reduced run-off from the Uluguru mountains, partly

caused by the illegal cutting down of forests. That means that, at the time of year when irrigation is most needed, the pumps cannot be used.⁹ It is therefore only possible to get a single crop in a year, rather than two crops, which means that overall yields are not greatly more than those achieved by farmers growing rice in the swamp nearby, who do not have to pay the costs of the irrigation (in particular the electricity bills for the pumps).

When water is abstracted, there are frequent disagreements about its allocation. Those who farm the blocks closest to the pumps get the water they want. Those far away have to wait a long time, often missing the best time to plant their rice, or do not get any water at all. [This is a generic problem with large scale irrigation – I need to find a textbook ref that makes the point].

As with most of the large-scale irrigation projects from the 1960s on in Tanzania, there are technical problems with the irrigation – inadequate levelling meaning that the distribution of water over the field is not consistent, and there is a danger of evaporation of standing water leaving behind salts that were dissolved in the water. And failure to build canals to return as much surplus water as possible to the river for uses further downstream is today recognised as a serious failure in the planning of this kind of irrigation scheme. Even more so if standing water is used as a means of controlling the growth of weeds. [I am fishing a bit here as I do not know precisely how serious these issues are at Dakawa].

Finally, there are financial disputes over the bills for the irrigation (T.Shs. 60,000 per acre in 2013 but expected to rise substantially the following year – paid to UWAWAKUDA who must pay the electricity company TANESCO for the electricity to run the pumps). This money also has to cover the costs of a farm manager employed by the cooperative. At the time of the fieldwork, it was clear that this

⁹ This was the case in 2013. But it appears to be a generic problem, occurring in most years.

income was not sufficient to cover the costs. These problems became much worse when the Government unexpectedly authorised the import, duty free, of a large quantity of cheap rice, causing the price of rice earned by the farmers to fall.

The project was researched by a postgraduate student Christopher Mdee in 2013¹⁰ and further written up by a team led by Anna Mdee in 2014¹¹. Their main conclusion, supported by several of the engineers they interviewed, is that the lack of water in the dry season means that it can never be a commercial success, and that, in that sense, the considerable investment in rehabilitating the pumps is wasted.

¹⁰ Christopher Mdee. *The potential for irrigated rice production to enhance small-holder livelihoods in Tanzania: Exploring the profitability, productivity and sustainability of the Dakawa Rice Farm* MSc Dissertation University of Bradford (Mzumbe programme) 2013, accessed at <https://www.sussex.ac.uk/webteam/gateway/file.php?name=mdee-dissertation-final.pdf&site=11> on 6 February 2016.

¹¹ Anna Mdee with Elizabeth Harrison, Chris Mdee, Erast Mdee and Elias Bahati *The Politics of Small-Scale Irrigation in Tanzania: Making Sense of Failed Expectations*. Future Agricultures Working Paper 107, 2014. Accessed at <http://www.future-agricultures.org/publications/research-and-analysis/1915-the-politics-of-small-scale-irrigation-in-tanzania-making-sense-of-failed-expectations/file> on 6 February 2016, pp.15-20.

ⁱ This disclaimer informs readers that the views, thoughts, and opinions expressed in the text belong solely to the authors, and not necessarily to the author's employer, organization, committee or other group or individual.