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Frameworks and Farm Management Strategies for Sustainable Intensification in Sub-Saharan Africa

E. John Wibberley & Martin M. Turner

Abstract

Economic power has been shifting globally from west to east for decades now, largely by-passing the continent of Africa. However, Africa has been drawn into globalisation effects - especially the downsides of liberalised arrival of cheap farm produce from abroad displacing home agricultural production. Following the world financial crisis of 2007-08, former speculators in various 'financial packages' and previously rising housing markets have now turned their gambling eyes to bet upon the burgeoning world population and its rising demand for food. They are thus seeking to control the means of production of food - looking for spare land to buy or lease cheaply, and trading in agricultural produce speculatively. Africa beckons them as having apparently more 'spare land' than elsewhere. This Paper acknowledges the value of genuine investors in African land for human benefit, but warns of the need to pursue agricultural development in Africa on the basis of 'economy for enough' among its indigenous farming communities, not unchecked global greed. Rather than industrialised hi-technology, large-scale approaches, it argues the case for sustainable intensification with Africa's own resources properly managed by Africa's own host of small farmers using ecologically and geo-politically sound land-to-mouth technologies.

Introduction

Revising the Economic Paradigm

The etymology of the term 'economy' derives from *oikos* ('home', with all the inter-relationships that implies beyond the mere dimensions of the 'house') and *nomos* ('law' or 'rules of management'). The full word *oikonomia* thus means 'the caring management of all creation's resources for the benefit of the whole creation'; agriculture is integral to this - and is 'at a cross-roads' (IAASTD, 2009; *The Royal Society*, London, 2012).



Writings on the theology and economy of 'enough' have included the seminal work by Taylor (1975) affirming the importance of 'enough'. Schumacher (1974, 1980) propounded the study of economics 'as if people mattered' and the criteria for 'good work'. Pearce *et al* (1989) propounded the need for proper 'environmental accounting' for a 'green economy' that respects the intergenerational nature of earth's resource management. Korten (1995) drew attention to the damaging impacts of growing Transnational Corporate power. Stephens (1998) emphasised the 'institution-wariness' of Jesus and propounded the importance of 'thinking communally but acting personally' in both resource management and civil society terms. Stiglitz (2002) drew attention to globalisation's 'discontents'. Wibberley (2007) emphasised, that we have reached a point of urgency in considering 'when enough is enough' for agriculture. In order to revisit and implement *oikonomia*, we need not only the concept of 'consumption greed' but also 'production greed' - and to move towards 'sustainable consumption' for spaceship earth' (long ago propounded by Boulding, 1945, 1966; Heap, 1997) using sustainable production methods. Management is needed towards 'food futures' (Rozel Farnworth *et al*, 2008), while there needs to be a new paradigm for financial markets as discussed by Soros (2008). Schluter (2009) has even questioned whether capitalism itself has reached moral bankruptcy. Genuinely free enterprise actually requires the sort of boundaries which are at present largely lacking in international trading both in fact and in policy aspiration. To employ a transport analogy, a 'Highway Code' protocol is urgently needed to rectify this situation (Wibberley, 2005, 2011a). Markets need managing with moral non-market norms (Sandel, 2012). As we 'push frontiers' in development, we need to heed the finitude and scarcity of earth's resources (Barbier, 2012) in pursuit of 'enough for all'. The management vision needed is of rural Africans applying hard work and sustainable technologies on their own land, there to care harmoniously for their environment, communities and future (Kyamuwendo & Wibberley, 2009; Kassam & Uphoff, 2012 - based on Laulanié's practical work on the system of rice intensification with Madagascar's small farmers, using 2/3-leaf seedlings quickly transplanted at 25x25cm at 1 per hill, restricting watering and applying compost).

Africa's strengths and realities

Of the 7 billion world population, just over 1 billion are in Africa. There will be about 9.3 billion by 2050, with a 110% increase in sub-Saharan Africa. Almost 1 billion are hungry now and some 70-100% more food is needed by 2050 (FAO data 2011). Africa has 22% of world land; some 14% of world population; 3.3% of world purchasing power. Africa has many

old civilisations and economies – in Southern and West Africa, as well as Ethiopia and Egypt (Hugon, 2004). Africa is rich in natural resources including creative people, has a burgeoning middle class of some 300 million people, often has countries with lower % indebtedness than many western powers now, and has higher economic growth rates than they do – albeit from low baselines. Africa is huge (30.2M km²; China just <9.6 Mkm²; USA just >9.6 Mkm²; India 3.2 Mkm²). Africa's natural resources are immense and being increasingly eyed greedily by the Chinese and many other financially wealthy nations and speculative private investors. Africa has the World's Longest river (Nile – at 6695 km); Biggest desert = Sahara (8.6 M km²). Africa is rich in wildlife, with African elephants protected by CITES with regard to the ivory trade, but jobs are needed by some licensed users and game farming can be a viable option for profitable business consistent with thus duly incentivised game conservation. Crops originating in Africa include:- coffee (Ethiopia), baobab trees, water melon, ginger, okra, roselle (for fruit drinks), cowpeas, pigeon peas, millets, hungry rice (*Digitaria exilis*), elephant grass, indigo (for dyes), bottle gourds, castor oil, *Agapanthus* lily (RSA).

As regards Human Development Index (HDI), the world's 27 countries with lowest HDI are in Africa. Yet also there are the richest diamond and gold sources (South Africa, Sierra Leone...). The poorest countries (in purchasing power terms) in the world are Somalia followed by Sierra Leone. Burundi has the lowest GDP per head in the world. Africa's largest economy is the RSA (one-third of all SSA's GDP); largest population is Nigeria (>150 M). Niger has the highest births per woman (7.9) and fastest growing city in the world (Niamey). It is rated the least developed country in the world, and has the fastest growing overall population at nearly 4% per annum. Uganda has population growth at some 3.3% per annum. Swaziland has the lowest life expectancy in the world (30) owing largely to its very high HIV/AIDS. Tanzania has the most refugees of any African country (>600,000). While the top cocoa producers in the world are Ivory Coast & Ghana, Zimbabwe has the highest inflation in the world (it has been 'off the scale' and printing 50 trillion dollar notes etc). Countries most dependent on agriculture are African (Guinea Bissau >60% of GDP; Sierra Leone 58%).

Africa's Threats and realities

Unregulated Trading conflicts with Africa's environmental conservation and sustainable livelihoods. While trade equity issues persist and must be addressed, the removal of all regulation would be suicidal for Africa's environment and livelihoods. Furthermore, those with a vested interest in

expansion of trade – many larger corporations – are also those who control biotechnology companies.

Threats for Africa arise particularly from:-

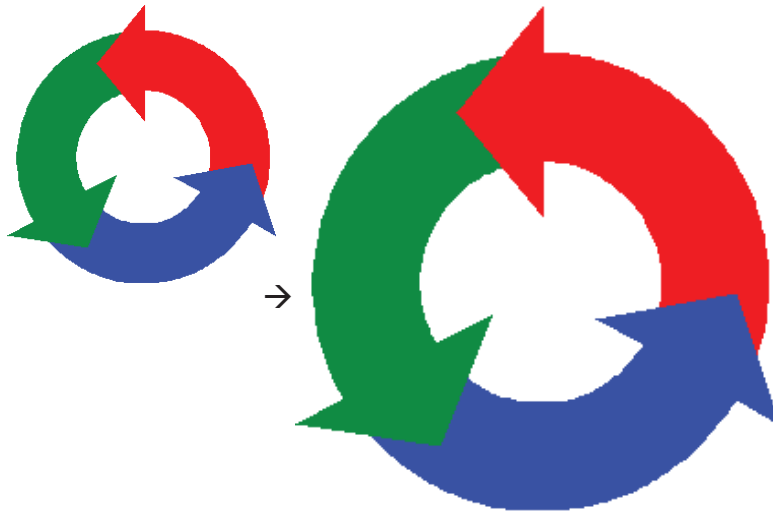
- a) THE BURGEONING SCALE OF LAND-GRABBING (by purchase or long-term renewable leases) for control of water as well as agricultural outputs (including bio fuel instead of food crops) and minerals (Wibberley, 2011b; Pearce, 2012). Indigenous and local communities of Gambella, Ethiopia - 70,000 people in all - are being forcibly relocated to make land available for investment in agriculture. There are plans to relocate an additional 150,000 people, most of whom are subsistence farmers who have been able, until now, to feed their families without receiving government or foreign aid over the last twenty years (Oakland Institute, 2012 – open letter to US President Obama).
- b) IMPOSED AND OFTEN INAPPROPRIATE TECHNOLOGIES – notably those displacing people and reducing farmer independence to operate local land husbandry;
- c) CONFLICTS DISPLACING PEOPLE FROM THEIR TRADITIONAL LANDS;
- d) CLIMATE CHANGE, which has important implications for food production, processing and distribution and thus for food security. Practical responses and planning are particularly urgent for Africa (Mortimore & Manvell, 2006; Villon & Wiskerte, 2012).

The immediate threats for Niger are evident; already 80% of its total area is desert and only 3% is cultivable. Millet yields have declined to some 90% of those attained 50 years ago while average sorghum yields are now only 20% of those achieved half a century ago. Niger's current population of 15 million is projected to rise above 20 million by 2020 and to between 43 and 77 million by 2050, depending on the success or otherwise of birth control measures adopted (Guengant and Banoin, 2003). According to culture, many of the extra people will wish to keep more cattle, goats and sheep. However, under much more favourable rainfall conditions, *Send-A-Cow* in Uganda (www.sendacow.org.uk) did studies showing huge positive impacts of a single cow or dairy goat on Farm-Household System vitality and viability – and in such integrated systems that the carbon-footprint (notably methane + manure) is offset by recycling, by fodder crops and by tree planting so that over 5 years it is 2.5 times positive! Fuel-efficient moulded mud stoves, and more tree conservation, planting and care is also needed – treasuring trees (Wibberley, 2012).

Africa’s Management Potential: Principles & Practices of Sustainable Intensification

Sustainable agricultural intensification (Fig.1) means producing more output from the same area of land while reducing negative environmental impacts and positively conserving biodiversity. Some say it is an oxymoron. But is it? ... It might well be if increasing farm size and industrialisation is equated with ‘intensification’ but agro ecology could answer (Koothafkan *et al*, 2011). The ‘Great Green Wall’ of trees proposed in 2012 by Dennis Garrity of The World Agro forestry Centre (formerly ICRAF; www.worldagroforestry.org) will extend from the Senegalese coast to the Djibouti coast upon completion. It can be achieved when practices such as Evergreen Agriculture are used, which offers one of the best defences against desertification because its affordable, sustainable and accessible farming methods benefit not only rural smallholder farmers but also the environment (see Maathai, 2009).

Fig. 1. Sustainable Agricultural Intensification: Recycling & Better Management but still the three essentials of ECONOMY, ECOLOGY, SOCIETY.



In general, conditions favouring beneficial microbiological activity also favour crop root systems and thus consistent good yields, with the special case of paddy soils for wetland rice. Correct physical conditions of soil structure - through judicious land drainage and cultivations - are both a prerequisite for better soil microbiological activity and further improved by it. Integral to high microbiological activity is the management of a suitably benign soil pH, typically around 6.5 for a majority of crops. In conjunction with this, it is vital to maintain adequate levels of all essential crop nutrients. Improved crop output can be achieved in practice by judicious use of composting, plant teas (liquid nutrient preparations), organic manures and mineral fertilisers. A fertile soil can generate further fertility through the better root systems left in soils after high-yielding crops, particularly if this is managed together with the integration of livestock within cropping systems plus the proper use of crop rotations and mixed cropping. Conservation farming (CF), whereby cultivations are minimised saving both energy and moisture, is proving highly beneficial globally.

Conservation Farming (CF)

Conservation farming (CF) incorporates many timeless concepts of good husbandry. It links reduced early cultivation, seed and nutrient placement, mulching, rotations (Oldrieve, 1993). African and other tropical farmers traditionally practiced shallow cultivation anyway. 'Zero tillage', 'No-till', Minimal cultivations are 'Western' mechanised and biocide-dependent ways of doing it. CF offers a disciplined, adaptable management approach for all (not fixed 'package'). CF is 'sustainable agriculture' but precise management may favour 'packaging CF'. CF benefits of water & OM conservation with soil structural improvement are cumulative but rely on enough previous crop yield and thus proportionate root activity and residual mulching matter. CF uses no or low-cost means including opportunity cost of farmers' dry season time to prepare early. CF can easily use organic and inorganic fertilisers, with hand, animal-draft or tractor power. Minimal cultivation may change weed ecology needing more initial in-crop weeding and maybe more perennial, especially grass weed control later; it may need glyphosate weed-wiper. Weed control is critical in all systems; CF can use 'opportunity cost' of farmers' labour for frequent and timely cultural control of weeds. Conservation farming merits promoting widely (Kassam, 2011; www.fao.org/ag/ca).

CF in Zambia (ZM) was popularised after 1996 (inspired by Brian Oldrieve of Zimbabwe; also called '*Farming God's Way*' and later '*Foundations for Farming*' by him). It uses dry season minimal tillage with rip lines or hand-hoed basins on a 70x90cm grid (15,850 stations per hectare), with

no burn, with mulch, and with N-fixing rotations. CF involves planting in basins ('pot-holing'). This needs enough clay and/or OM in soil to maintain stations and is appropriate for short erratic rainy season zones (80-120 days; 750-800 mm) – which applies to half of Zambia. It has been found that CF in ZM can boost yield of maize and cotton by early planting and moisture conservation. It enables 2 weeks earlier maize and cotton planting worth an extra 500kg/ha yield, and is used by some 250,000+ farmers (of 900,000 total) especially adopted by emulating current users (Chenda, 2012). Energy-saving is vital, moving only some 15% of soil by contrast with overall tillage. CF with a 2-year agro forestry rest (of *Sesbania sesban*, *Tephrosia Vogelii*) is used by the World Agro forestry Centre. Zambia tried alternating a year of sunn hemp (*Crotolaria*). Notably interplanted *Faidherbia [Acacia] albida* at 100 trees/ha (in leaf in dry season can fix 300 kgN/ha). West African Sahel experience suggests CF 'basins' can boost yields double to tenfold; labour constraint is key – for dry season land preparation and weeding. In Malawi, heavier soils and excess January rain in basins may result in low CF yield if there is little mulch. It has been found necessary to weed up to six times. Apparent reasons for adoption of CF since around 1996 in Zambia by some 250,000+ farmers can be summarised:-

- Practical farmer led and developed (Aagaard, 2011);
- Motivated extension team-work; Farmer-to-farmer adoption is encouraged;
- Adequate fertiliser used to get good yields (including of mulch residues); on-farm yields of up to 9 t/ha maize and 3.5 t/ha cotton attained using the order of 20:40:20 kg NPK + top-dressing of 90-100kg N as urea, + limestone as needed;
- Adaptive technology introduced (including the *Chaka* hoe, *Magoye* Ripper, *Zamwipe* weeder, *Teren* rope marker – with spaced bottle-caps at 70 cm for maize);
- Good liaison with cognate field research centres;
- Biodiversity has been encouraged with location-tested cropping systems;
- Agro forestry is used (especially 100/ha of *Faidherbia albida* trees);
- A CF Unit has produced excellent promotional materials including booklets and CDs;
- The Zambia National Farmers' Union (ZNFU) & Government of Zambia endorses CF;

- Focus is on agronomic management/extension (liaising with others re storage, marketing;
- Headmen in villages allocate land for use and are key promoters for CF;
- Neighbours help each other in fieldwork and discuss their CF experiences together.

Elsewhere, over half Brazil's farmland is now using zero tillage (CF) with huge savings and high yields. The Indo-Gangetic Plain, with 13.5 Mha of the world's most intensively farmed area producing 45% of S.Asia's food, CF is being adopted farmer-to-farmer.

Discussion & Conclusions

Africa is at a tipping point. From years of being described in terms of what the continent lacks and being perceived as a 'poverty basket-case', the continent is now - especially post the financial crash of 2008 - seen as a leading investment opportunity. The message of this paper is that unless Africa raises its collective voice clearly for management with vision, its huge and wonderful resources will be yet further jeopardised for future generations. Africans themselves need to manage Africa from macro to micro levels. There need to be enough farmers 'there to care'?. Trading and Investment Protocols are urgently needed for the long-term well-being of African agriculture. Sustainable technologies from field to plate are required and can substantially boost productivity and secure livelihoods and food supplies. 'Sustainable intensification' is possible but only with appropriate local management at farm level across Africa. The moral challenge is to shape market-led development in ways which recognise the role of traditional patterns of social and cultural exchange, harnessing the best of the existing while benefiting from the dynamism which proper markets can bring.

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