

# Understanding different perspectives on Sustainable Agricultural Intensification and how it can be achieved

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## SAIRLA Programme

The DFID-funded Sustainable Agricultural Intensification Research and Learning in Africa (SAIRLA) programme has been designed to generate evidence and tools to understand the factors that may contribute to different outcomes from SAI for poorer smallholders, particularly women and youth. The research is focused upon three key themes:

1. What factors affect the equity of outcomes from SAI?
2. How can economic, social and environmental trade-offs be managed?
3. What services are needed to support SAI outcomes for smallholder farmers?

For SAIRLA, the programme is seeking to facilitate multi-stakeholder social learning processes that can robustly challenge these different visions, so that decision-makers and other stakeholders can engage and strengthen their capacity to understand and address the trade-offs involved in different pathways and choices. A clearer articulation of the trade-offs and potential synergies, and their sustainability, intensification and equity implications will help to inform public discourse, including farmers, and policy-makers and investors, supporting their decision-making. SAIRLA, through national learning alliances, seeks to support national stakeholders to strengthen their capacity to inform the process and outcomes regarding the different pathway options and their implications.

## Acroymns

Acronym	
DFID	Department for International Development
FAO	Food and Agriculture Organisation
IIED	International Institute for Environment and Development
SAI	Sustainable Agricultural Intensification
SAIRLA	Sustainable Agricultural Intensification Research and Learning in Africa
SDG	Sustainable Development Goal
SSA	Sub Saharan Africa
UN	United Nations

# Contents

<b>1</b>	<b>Introduction: Increasing demands on agriculture</b>	<b>6</b>
<b>2</b>	<b>How has SAI been understood to date?</b>	<b>7</b>
<b>3</b>	<b>How has SAIRLA approached Sustainable Agricultural Intensification to date?</b>	<b>8</b>
<b>4</b>	<b>Why and how should issues of equity be considered in relation to SAI?</b>	<b>9</b>
<b>5</b>	<b>Broadening the environmental dimension of sustainability</b>	<b>11</b>
<b>6</b>	<b>Different agricultural development pathways and their implications for SAI and equity</b>	<b>12</b>
<b>7</b>	<b>Conclusion</b>	<b>19</b>
	<b>References</b>	<b>20</b>

## Executive Summary

Sustainable Agricultural Intensification (SAI) was originally conceived as a term to capture the need to increase agricultural productivity, while not expanding the area under cultivation and minimising the impacts on the environment. Subsequently, the 'sustainability' part of the term has been expanded to include social, environmental and economic components, and with greater recognition that this sustainability is essential to maintaining any gains in productivity.

There is less consensus on how it should be achieved in practice.

Increasing agricultural productivity through using agrochemical inputs and improved seeds, together with the economic investment to pay for them has received more policy support to date and is seen as one pathway.

An alternative approach is agroecological intensification which focuses upon the application of ecological knowledge and practices to improve sustainability of production, without dependence on external inputs and with a stronger emphasis on localized markets and self-sufficiency.

Some form of integration between the two in order to capture the benefits of both approaches has been proposed by some scholars and practitioners. Nevertheless, trade-offs exist between the overall approaches in terms of sustainability, intensification and equity outcomes and particularly when different scales are taken into account.

Substantial increases in the demand for food are foreseen globally. This is especially the case in fast growing regions such as Sub-Saharan Africa where increases in agricultural productivity have fallen behind the rest of the world. Sustainable Agricultural Intensification (SAI) was originally conceived as a term to capture the need to increase agricultural productivity, while not expanding the area under cultivation to minimise the impacts on the environment. Subsequently, the 'sustainability' part of the term has been expanded to include social, environmental and economic components, and with greater recognition that this sustainability is essential to maintaining any gains in productivity.

Nevertheless, there are different pathways promoted for achieving this objective. Increases in agricultural productivity have been perceived as more readily achieved under larger-scale or commercial agriculture using agrochemical inputs and improved seeds, together with the economic investment to pay for them. This view has been challenged, however, with respect to the impacts upon equity of these investments as well as questions being raised on the environmental impacts and longer-term sustainability of such approaches. Agroecological intensification is presented as an alternative by some scholars and practitioners. It focuses upon the application of ecological knowledge and practices to improve sustainability of production, without dependence on external inputs. This non-dependence on external inputs means that agroecological approaches are often viewed as being more accessible to poorer smallholders and thus more equitable.

Recognising the benefits of both, it has been proposed that agroecology and more technological approaches need to be integrated in order to capture the benefits of higher productivity, obtained with some agrochemical use, commercial investment, sustainability through agroecological practices, and equitable access for smallholders. Nevertheless, trade-offs exist between the overall approaches and between elements of them, for example, smallholders have limited power in negotiating access to investment for purchase of inputs or access to markets.

The SAIRLA programme intends to improve our understanding of the equity implications of different approaches and to provide tools to support decision-makers to better understand potential options and to manage trade-offs, and to identify processes that would improve smallholder access to the services (agroecological or technological) they need to invest in improving agricultural productivity.

# 1 Introduction: Increasing demands on agriculture

**This paper aims to provide an overview of Sustainable Agricultural Intensification (SAI).** It sets out the common differences in interpretation of SAI and approaches to achieving it, to inform sub-Saharan Africa (SSA) stakeholders as they contextualise SAI in diverse national and local contexts and in the wider global context. In turn, SSA stakeholders will seek to inform and engage decision-makers to as to what constitutes an effective enabling environment that will enable poor African smallholder farmers, especially women and youth, to benefit from SAI and agricultural development in SSA.

**Global demand for food will increase significantly.** Over the last fifty years food production per person in Africa has grown disappointingly slowly at little more than 10 per cent. Africa's population of just over 1 billion in 2010 has an average annual increase of 2.5 per cent is projected to reach 1.6 billion by 2030 (UN, 2013). Over the past decade (i.e. since 2005) agricultural productivity is thought to have increased by about 3.6 per cent per annum (AGRA 2017). Nevertheless, chronic hunger on the continent remains high; nearly 23 per cent of the population are classed as hungry, many of whom are farmers owning less than two hectares of land. Smallholder farms in SSA number around 33 million, representing 80 per cent of all farms in the region, and contributing up to 90 per cent of food production in some countries (Wiggins and Keats, 2013). Developing smallholder agriculture can be effective in reducing poverty and hunger in low-income countries, but only through sustainable access to markets can poor farmers increase the income from their labour and lift themselves and their families out of poverty.

**The demands on agriculture are not solely limited to production levels, but to a multiplicity of issues.** The multiple demands are now being placed upon agricultural lands (Smith 2008), as well as increasing productivity, food production and food security, there are other inter-connected demands being made upon agriculture, including:

- being resilient to climate change (coping with and recovering from shocks and stresses);
- recognising that natural resources are finite and supporting the provision of other ecosystem services (for example, climate regulation, water availability and quality) upon which we all depend, as well as food, fuel and fibre;
- diversifying away from fossil fuel-based growth, because these resources are finite and their use a major source of greenhouse gas emissions;
- agricultural expansion and intensification is a major cause of biodiversity loss and mass species extinction
- promoting economic development, poverty reduction, rural employment and value addition in developing countries.

**Many of these production, poverty and sustainability demands are encapsulated in the United Nation's Sustainable Development Goals.** In particular they are covered by SDG2 which aims to *End hunger, achieve food security and improved nutrition and promote sustainable agriculture.* See Box 1.

**Box 1: United Nations Sustainable Development Goal 2 Targets**

2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilisation of genetic resources and associated traditional knowledge, as internationally agreed

2.6 Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries

**Although there is widespread agreement that demand for food will increase substantially over the coming decades, there is less clarity on how this demand will be met.** For example, it is debatable how far demand needs to be met through increases in agricultural productivity, moderating demand through reductions in food waste and changes in diet (primarily reducing demand for livestock products), or changes to the food system to ensure more equitable access to a healthy diet (Garnett 2013). At least for regions with fast growing populations, increasing food production or massively increasing imports is likely to be necessary (van Ittersum *et al*, 2016). The challenge is how to achieve increased production, while delivering on other sustainability imperatives. There is limited agreement on the definition of the term ‘Sustainable Agricultural Intensification’ and far less on how it should be achieved in practice – issues which are discussed in the following sections.

## 2 How has SAI been understood to date?

**Definitions of Sustainable Agricultural Intensification have evolved, becoming broader over time, but are still contested.** An early definition of SAI was provided by the Royal Society: “yields are increased without adverse environmental impacts and without the cultivation of more land” (Royal Society, 2009). The Montpellier Panel (2013) expanded on this definition to consider intensification as producing more outputs (production) with more efficient use of inputs on a durable basis, while reducing environmental damage and building resilience, natural capital and environmental services.

**Many definitions now include social, environmental and economic issues.** The Sustainable Agriculture Initiative Platform, a private sector initiative, and the Sustainable Food Lab (2009) adopt the sustainable development three pillars approach (environmental, social and economic), addressing these as intertwined issues. The SAI Platform defines sustainable agriculture as “a productive, competitive and efficient way to produce safe

agricultural products, while at the same time protecting and improving the natural environment and social/economic conditions of local communities." (<http://www.saiplatform.org/sustainable-agriculture/definition>). Similarly, broad in nature, the IIED review of SAI (Cook et al, 2015) also highlights the importance of wider considerations of sustainability than earlier definitions allowed for, including *social* as well as economic and environmental dimensions.

**The extent to which definitions and debates address the wider food system varies.** IIED and others (such as Garnett 2013 above) emphasise the importance of considering SAI within the wider sustainable food system<sup>1</sup>. Supporters of agroecological approaches certainly adopt a wide-ranging, systemic approach including issues of consumption, trade as well as production (Guzman and Woodgate, 2013).

**Further, broad-ranging definitions of sustainable agriculture are more inclusive, but they can be problematic in terms of providing practical guidance and so decision-tools may be helpful.** The multi-faceted nature of the issues being considered can make it hard to identify priorities for action and to understand the likely outcomes of interventions. Panell and Schilizzi (1999, cited by Gold 2007) discussing sustainable agriculture, suggest that the inherent characteristic of a multiplicity of dimensions impedes practical application and so decision-makers should identify sustainability issues of priority importance and use up-to-date information about the trade-offs involved using a multiple criteria decision-making formula (Pannell and Schilizzi, 1999). However, such an approach does not necessarily address issues of power and of distribution of outcomes. Who decides which issues are important and need to be tackled and which should be deprioritised? Who benefits and who loses from specific trade-off decisions? The risk is that those holding power can choose those aspects of sustainability of greatest interest to them and disregard others. Therefore, the framing of options within a decision-making tool becomes important.

**By giving equal weight to all three dimensions, definitions of SAI that employ the three pillars, potentially underestimate the potential need for restrictions on some types of economic activity** (for example, to reduce the use of fossil fuels) and on the equity implications of the trade-offs involved. Holden *et al* (2017) challenges the popular three-pillar approach by suggesting a model for sustainable development based on three moral imperatives: satisfying human needs, ensuring social equity, and respecting environmental limits. Rather, they argue that sustainable development constitutes a set of constraints on human behaviour, including constraints on economic activity.

### 3 How has SAIRLA approached Sustainable Agricultural Intensification to date?

**SAIRLA gives equal attention to sustainability (environmental, social and economic) and intensification of productivity objectives, while also seeking to clarify the equity implications of different potential pathways.** Sustainability issues should be given equal attention alongside intensification / productivity enhancing objectives. The SAIRLA programme seeks an outcome of more productivity per unit resource input

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<sup>1</sup> Defined by Cook et al (2015) as "... the people and resources involved in producing, processing, distributing and consuming food and managing waste...[it] operates within social, political, economic and environmental context"

(land, labour, water, capital) resulting from the process of agricultural intensification, while giving equal weight to sustainability issues (social, economic and environmental) and considering issues of equity (see next section for more discussion of the latter).

**Further work is envisaged within the SAIRLA programme to develop definitions, frameworks and indicators.** A framework from the Feed the Future Programme (Musumba *et al*, 2017), for example, proposes an extended framework for the evaluation of SAI, identifying five key dimensions: Productivity, Economic, Environmental, Human and Social dimensions each with proposed indicators. The assessment framework was primarily designed for use by researchers to evaluate SAI innovations, although it has potential for application in the performance evaluation of SAI projects and programmes. This extended framework sets out the potential elements of SAI, while needing more detail to unpack the relationships between these elements and fundamental questions of power and structure within which agriculture is practiced.

**SAIRLA recognises that broad definitions of SAI only have limited utility.** SAIRLA is supporting local stakeholders to research and explore SAI options in different contexts. A key route to understanding SAI is through an analysis of the drivers of intensification, i.e. 'What are the incentives for different types of farmers for raising productivity and how sustainable are the approaches employed?' Conversely, a key question in any particular context is: 'What factors are keeping productivity low and how is this socially differentiated?' For example, are there gender or socially identity-related discriminations in extension services, which constrain productivity? This type of analysis can then inform policy and investment strategies.

## 4 Why and how should issues of equity be considered in relation to SAI?

On a global level, there is a significant increase in inequality and inequity, resulting from processes of globalisation and economic integration (Hickey and du Toit, 2007 cited by Jones, 2009). Equity should have much greater prominence on policy agendas with greater definitional clarity to guide progress towards development goals (Jones, 2009).

**Equity comes from the idea of moral equality, that people should be treated as equals:** 'Thinking about equity can help us decide how to distribute goods and services across society, holding the state responsible for its influence over how goods and services are distributed in a society, and using this influence to ensure fair treatment for all citizens. Applying these ideas in a specific country context involves hard choices and embedding discussions of distributive justice into domestic political and policy debates is central to national development' (Jones, 2009, pvi). Jones (2009) suggests three key features where there is widespread consensus on equity in development:

1. *Equal life chances:* There should be no differences in outcomes based on factors for which people cannot be held responsible.
2. *Equal concern for people's needs:* Some goods and services are necessities and should be distributed according solely to the level of need.
3. *Meritocracy:* Positions in society and rewards should reflect differences in effort and ability, based on fair competition.

**Equity and equality are closely related but are not synonymous concepts.** Equity focuses on what constitutes a just distribution, which treats people equally, whereas equality is about what the final actual distribution is, requiring that people receive equal amounts. The former concentrates on 'fairness' and 'processes', and the latter focuses on the final distribution 'of some goods or outcomes between different individuals or groups (for example, between people in different locations within a country, between people of different caste, class or ethnic group, between genders and between different levels of wealth' (Jones, 2009). Inter-generational equity is particularly relevant in relation to sustainable development.

**Gender equity means fairness and impartiality in the treatment of women and men, according to their respective needs (FAO, 2009).** Gender-based discrimination is widely recognised as a barrier to human development. For example, Nelson et al (2015) found that 'gender inequality in land rights in dryland countries and across the developing world more broadly remains pervasive. This is related to discriminatory socio-cultural norms that are found in customary and statutory institutions and practices that differ according to local contexts. In addition, women often lack representation and the authority to make decisions in land management and governance'. Women and men should be afforded the same human rights if gender injustice is to be tackled. As well as tackling gender discrimination, it is similarly important to respect the human rights of and to tackle discrimination against other marginalised groups, such as people living with disability or those located in remote regions.

**Given these challenges relating to rising inequality, what does equity mean in the context of SAI?** - Does it mean "leaving no-one behind"? It may be argued that SAI is not for those who are currently the most food insecure, resource poor or otherwise vulnerable. DFID's agricultural strategy identifies three groups, those who can potentially 'step-up' to a better livelihood based on agriculture but considers that this may not be feasible for the poorest for whom 'hanging-on' until they can 'step-out' of agriculture (and receiving support to do this) is probably their best route out of poverty (DFID's Conceptual Framework on Agriculture, 2015). One of SAIRLA's aims is to help clarify the implications of this strategy in different contexts, including issues of equity.

**Equity issues need to be fully considered in understanding the trade-offs implied in different contexts and between potential intensification pathways.** The notion of trade-offs should be problematised: What is being traded off against what? Who are the winners and the losers (within and between households and regions)? What assumptions underpin developmental politics, policies and debates and are they robust? Essentially, to achieve *equitable* SAI outcomes requires testing of many of the assumptions which have been taken for granted to date in the formulation of agricultural policies. The SAIRLA impact statement refers to 'enabling poorer smallholders, women and youth', but does this necessarily include the 'poorest'. This broad statement gives room to recognise the significant challenges relating to issues such as land availability and demographics which may entail some farmers leaving agriculture, but the emphasis on the theme of equity within the programme seeks to ensure that the equity implications of the different pathways and their associated trade-offs are appropriately articulated and fully understood.

**Equity has been insufficiently analysed with respect to different SAI pathways and options.** The SAIRLA base-line study demonstrated that decision-makers lack the evidence and tools to assess gender and generational impacts of agricultural development processes and thus the equity of their outcomes. There has been a tendency for equity to be solely considered a 'social' issue, but equity is a cross-cutting issue. Equity is relevant in decision-making on agricultural development pathways in terms of the trade-offs involved,

which issues are prioritised, and which approaches adopted. Any policies, investments and rural processes of change, including intensification (by large, medium, or small-scale farmers) will inevitably have winners and losers. Therefore, SAIRLA sees equity as a cross-cutting issue for SAI.

## 5 Broadening the environmental dimension of sustainability

**The environmental dimension of sustainability needs to be broadened from original conceptions focused purely on non-expansion of agriculture.** The simple objective of increasing agricultural productivity while minimising adverse effects on the environment, and particularly no expansion in land-area, suggests a vision of land being allocated to either food production or for generating ecosystem services, such as conserving biodiversity (known as a 'land sparing' strategy (Green *et al*, 2005). There are two limitations. Firstly, agricultural production requires other ecosystems services to be productive and sustainable. For example, if the negative environmental consequences of intensive agricultural production (for example, contamination of water sources from fertiliser or pesticides) are to be ameliorated then this requires better management of the supporting and regulating ecosystem services that naturally play these roles. Secondly, ecosystem services generated by land spared from agricultural production do not necessarily replace those that might be generated by land being cultivated. For example, while land sparing might work for carbon stocks, it does not apply to the regulation of water flows, where run-off from agricultural land is not readily compensated by infiltration from non-agricultural areas.

**Environmental sustainability requires investment production methods that have the potential to strengthen sustainability and resilience:** these may include practices that integrate biological and ecological processes such as nutrient cycling, nitrogen fixation, soil regeneration, and natural pest regulation (Pretty *et al*, 2011). While SAI should not focus on the sustainability dimension alone, it is nonetheless essential, as argued by the FAO, that the farming system be developed to conserve land, water, and plant and animal genetic resources, be environmentally non-degrading, and at the same time economically viable and socially acceptable. Agricultural sustainability, therefore, is much more than ensuring protection of the natural resource base. To be sustainable, agriculture must meet the needs of present and future generations for its products and services, while ensuring profitability, environmental health, and social and economic equity.

**A key component of sustainability in SAI is 'resilience'.** This means developing farming systems that have the capacity to absorb perturbations (shocks and stresses), such as those caused by climate change, and wider forces degrading the natural resource base, and so persist without qualitative changes in structure. A system that under normal conditions can guarantee the continuity of production (persistence) is not sustainable if it is not able to withstand perturbation – be it environmental (unpredictable weather), biological (pests and diseases) or social (debt, economic recession). A resilient farming system reduces risks for farmers from the hazards of climate change, and to debt incurred in high use of costly external inputs that may not provide a return due to variability in rainfall or drought.

**More research is needed on the relative resilience and profitability of different farming systems, and their equity implications.** It is commonly believed that while farming systems based on agrochemical inputs maximise short-term profits, they are less able to withstand climatic and economic shocks than diversified agroecological production

systems. Although the latter may be less productive and profitable in the short-term, they are also commonly considered more sustainable and resilient in the long-term. An in-depth review of research is required to better understand the relative resilience and profitability of different types of farming systems in different contexts and conditions, and of their equity implications.

## 6 Different agricultural development pathways and their implications for SAI and equity

### **There are broad contextual trends in sub-Saharan Africa, which shape policies and investments:**

For example, rapid population increase; urbanisation in many cases; a rapidly increasing middle class; changing climate variability and climate change issues. Globalisation of markets is also likely to continue, although the extent and direction of this process is not inevitable. African domestic and regional food production and/or food imports will have to increase to meet the growing food demand and to allay global food concerns in the light of climatic and other stressors on agriculture and rural societies. How change happens in specific countries will be informed by: a) how we understand agriculture and its roles in society (issues of framing); b) how agriculture, agricultural research and other services are carried out and by whom, (practices) and, c) how agriculture is regulated, controlled or guided (governance) (Scoones, 2017). The latter will be shaped by national policies and institutional frameworks, but also by global political economy factors.

#### **a) Scale of farming: the role of small, medium, large and agro-industrial farms in agricultural development**

### **Debates on sustainable agricultural development in Africa have been somewhat polarised in recent years.**

On the one hand, some observers view small-scale farming as the future (as a driver of economic growth and poverty reduction), while on the other hand, others promote large-scale commercial investments in agricultural development as the means to these same ends. The post-millennial decade saw the re-emergence of the smallholder-led model of agricultural growth. This was based on the conviction that smallholders, if given the necessary commercial incentives and technological inputs, would be able to enhance their own food security as well as ensuring a surplus for growing urban markets. This model underpinned the flagship World Development Report of 2008 *Agriculture for Development* as well as the Maputo Declaration from 2003 and had a strong influence on agricultural policy in many African countries during the decade. More recently, however, increased recognition of the segmentation within the smallholder sector and growing land fragmentation has led to fears of the marginalisation of weaker groups such as women and youth in smallholder agriculture (Jayne et al., 2014; Andersson Djurfeldt et al. 2018).

### **Recent work has identified the uneven nature of the policy playing field for smallholder farmers.**

Many policy levers have favoured large-scale commercial agricultural investments and failed to recognise the scale of investment made by smallholder farmers. An Oxfam and IIED report (Vorley *et al*, 2012) finds that despite widely varying contexts, current policy levers, such as public-private partnerships, the nature of tax incentives, and support for individual rather than collective land rights, favour larger-scale commercial operations, are 'non-inclusive' in nature and so disfavour small producers. It is often overlooked that small and medium-scale enterprises are significantly investing in transport,

wholesale, warehousing, cold storage, processing, local fast food and retail (Reardon, *et al*, 2013).

**Debates continue as to how to make smallholder agriculture work.** Hazell *et al* (2007) suggest that for smallholder agricultural development to promote growth and equity would require: i) getting the basic infrastructure and institutional conditions in place, ii) encouraging farmers to follow demand and improving marketing systems and iii) Innovation in providing inputs and services. Even if policies are appropriate, they may not be carried out, it requires that governments have an interest in mobilising the support needed and the capacity to do so implement change.

**Many authors concur that tackling smallholder access to markets is of critical importance, although there is less agreement on appropriate types of markets:**

Developing sustainable smallholder agriculture can be effective in reducing poverty and achieving food and nutrition security, but many farmers do not engage in or benefit sustainably from market access because they lack appropriate assets, infrastructure and incentives. To stimulate smallholder market participation, evidence suggests that facilitating smallholder organisation, reducing the costs of intermarket commerce, and improving poorer households' access to improved technologies and productive assets are central (Barrett, 2008; Seville *et al.*, 2010). For agroecologists much depends upon the nature of the markets to which smallholders are linked, with a greater emphasis on more localised networks and self-sufficiency.

**Proponents of large-scale agricultural investment suggest that such investments have greater chances of achieving higher levels of productivity and economic growth.** Such approaches have attracted support from investors, donors and governments in Africa in recent years. Large investments can offer 'good returns and linkages with local economies' (Locke and Quan, 2016). Large farms can significantly reduce transaction costs for buyers, higher up supply chains. In recent years there has been substantial research on the challenges of land acquisition and speculation by large companies and investors (for example, see Cotula, 2011) and concerns relating to the non-observation of key principles such as Free and Informed Consent in many cases leading to inequitable effects for local communities. The risks for, and limitations on, larger sized commercial investments for companies themselves are also increasingly recognised such as 'up-front costs and business risks', especially in the light of commodity price volatility. Donors are seeking to support new sustainable business models that can reduce risks for large investors, but also which can deliver on sustainability imperatives (for example, reduced deforestation agriculture). These, however, are at an early stage of intervention and there are likely to be pre-conditions for success, including strengthened property rights for marginalised groups and support for capacity strengthening for farmer groups. Large farms are often associated with less environmentally sustainable practices, but the extent to which this is necessarily true in practice should also be reviewed empirically (Baker, 2013) and the cumulative environmental impacts of many smallholders' practices should also be assessed at a landscape level, as opposed to at a farm scale only.

**Small-scale farmers in ecologically fragile and risk-prone areas have been historically marginalised and so sustainable farming and fair markets have had less opportunity to develop or have been undermined.** For example, smallholder farmers in dryland areas of the Sahel have been negatively affected by a lack of agricultural investment in these zones which are seen as generating insufficient returns compared with more favoured agricultural areas suited to cash crops such as cotton, cocoa, peanuts. Government policymakers view farming systems in such risk prone areas affected by climate change as unsuitable for investment based upon the use of external inputs, such as

improved seeds and agrochemicals. Yet these policies are based on assumptions which may not hold true – dryland areas can be highly productive and pastoralist systems highly adaptable to changing climates (Nelson et al 2015). If the assumption is made that smallholder intensification would be primarily based upon the use of external inputs, then this might categorise a household as being vulnerable and food insecure, and its members' only option would be restricted to 'stepping out' of agriculture. Yet, agricultural improvement may be feasible through agro-ecological methods, which have not received sufficient support to date. Some farm families in marginal agricultural areas may be able to reverse the degradation of their natural resource base, while increasing their productivity and resilience, employing agroecological innovations.

**Moving beyond a dualistic approach?** Most recently, there has been a questioning of uncritical commitments to smallholder agriculture. Collier and Dercon (2013) argue that production and labour productivity need to increase significantly and that large numbers of rural farmers will have to exit agriculture and move out of rural areas. They suggest that a more nuanced and dynamic approach to agricultural development is needed, encompassing differentiated modes of production and requiring new institutional and policy frameworks. However, they also argue that in many instances, the approach which is reliant upon 'mega-farms' with government discretionary allocation of vast tracts of land is also inappropriate (Collier and Dercon, 2013).

**A more nuanced approach is necessary because of an increasing gap between subsistence smallholders and more business-focused smallholders.** The problem of land fragmentation and increasing inequality in farm sizes is widely and increasingly recognised. Hazell and Rahman (2014) argue that there is an increasing gap between subsistence smallholders and those smallholder households that are more business-focused and often engage in non-farm income generation, so that policymakers should align their policies to this more complex rural reality. Policies for smallholder agricultural development thus should vary by context. In some cases, proponents suggest that smallholder development can both drive or sustain growth and deliver more equitable development outcomes (Hazell et al, 2007). In other cases, policymakers need to consider whether there are social reasons to support small farms. If not, the policy agenda involves establishing social safety nets for the poor and facilitating good exits from farming for small farmers (Hazell et al, 2007).

**The emergence of medium-scale African farmers is not well recognised.** Locke and Quan, (2016) review empirical evidence and note that farm size holding is more differentiated that is often reflected in dualistic debates which focus either on large-farms or on smallholdings. This more varied set of land holdings and ownership should be taken into account in policymaking.

**The empirical evidence identifies significant potential for intensification by smallholders, but there may be limits on intensification beyond certain population densities.** There is potential for smallholder-led intensification, but also the potential ceiling on intensified production and increased market output in some situations are not well understood. Intensification policies thus need to be adequately 'differentiated'. Smallholder-led intensified farming should not be dismissed and should be treated as a policy option that still has credibility (Locke and Quan, 2016). There are more commonly 'lower indicators' for intensification for Africa than for Asia, with less fertiliser applied, less irrigation area developed and fewer improved technologies deployed so there is significant potential for intensification. However, the assumption that increasing population density will automatically lead to intensified 'farm input use and production per unit of land area' should be questioned.

**There may be possible limits to intensification in areas of significant land pressure, without attend reorganisation in land holdings.** Locke and Quan (2016) suggest that there are conditions in which increased population density does lead to intensification (for example, Kenya, Ethiopia and Malawi, but not in Ghana), especially where there is access to markets. But possible limits need to be recognised: evidence reviewed in one study suggests that 'intensification-responses-decline, where population density exceeds 600 people per square kilometre' (Locke and Quan, 2016).

**Ultimately, while both large scale and smallholder farming may be appropriate in some places/under certain conditions, there are real constraints to both agricultural pathways and ultimately policy should move beyond agricultural to multi-sector responses.** This is because of observed 'population-land dynamics', especially the 'youth bulge' (Locke and Quan, 2016). Each pathway means different things in terms of the nature of land investment, as well as who wins and who loses, i.e. they have differing equity implications. To facilitate the development of both small and medium sized farmers and large investments that offer good returns and potential multiplier effects in the local economy, there is a need for enhanced land tenure security for 'less productive, land-poor farmers' as well as intensification by smallholders, so that equitable land transactions and transfers can occur (Locke and Quan, 2016, p6). Achieving *equitable* development requires such measures to ensure a just and fair distribution achieved through measures and innovations such as strengthened property rights, fair land transactions and aligned national development strategy (for example, tackling fertility issues, supporting urban economic development etc.) – but not necessarily that all smallholders can stay in agriculture.

Similarly, Frelat *et al*, (2016) also call for measures beyond agricultural production and the closing of yield gaps, arguing for multi-sectoral policy harmonisation, incentives, and diversification of employment sources rather than a singular focus on agricultural development. Recognising and understanding diversity among smallholder farm households in sub-Saharan Africa is key (Frelat *et al*, (2016). Wiggins and Keats (2013) also argue that most initiatives aimed at linking smallholders to markets do not reach the poorest and suggest that other interventions are needed to support the most vulnerable and marginalised (for example social protection, health and education, asset building, and job creation).

Thus, while the concepts of rural worlds as employed the *DFID Agricultural Strategy* helps to unpack the differentiation in rural communities, it does not adequately challenge some of the assumptions which have underpinned existing agricultural policymaking and investments, and which may be flawed.

## **b) Approaches to sustainable intensification**

It is clearly desirable to have more nuanced approaches to policy and investment strategies, and to learn more from the empirical data. At the same time, there are still choices to be made in terms of the agricultural development pathways chosen and their implications for the level of sustainability achieved in processes of intensification and in terms of equity. Those in favour of more agroecological approaches, argue that not only can these be an effective way of increasing production, but that *only* such approaches adequately tackle issues of social inclusion, human rights to food and sustainability issues and that large-scale commercial approaches and globalising markets are problematic in this regard.

## Box 2: Exploring debates on external inputs versus agroecological approaches

For some observers favouring agroecological approaches, SAI might imply a prohibition of, or at least a reduction, in agrochemical use. Globally there are many areas where agrochemicals are used in excess (for example, East Asia), however, in Africa agrochemical use is generally low and so their usage should be weighed against the need for improved food security.

Nevertheless, agrochemical use is increasing, and there are cases of misuse and over-use, and there are risks of agribusiness concentration. Better management of ecological processes is essential to improving productivity and making agriculture more sustainable – and this includes the more effective use of chemical fertilisers, in combination with practices that maintain good soil health. In Africa, it is unlikely that intensification can be achieved without some use of agrochemicals, but their usage could potentially be combined with agro-ecological methods to achieve intensification and sustainability.

One influential report by Pretty *et al* 2011 provides a detailed, but nuanced, set of principles for sustainable production systems, suggesting that they should exhibit *most or all* of the following attributes:

- utilising crop varieties and livestock breeds with a high ratio of productivity to use of externally and internally derived inputs;
- avoiding the unnecessary use of external inputs;
- harnessing agroecological processes such as nutrient cycling, biological nitrogen fixation, allelopathy, predation and parasitism;
- minimising the use of technologies or practices that have adverse impacts on the environment and human health;
- making productive use of human capital in the form of knowledge and capacity to adapt and innovate and social capital to resolve common landscape scale problems;
- quantifying and minimising the impacts of system management on externalities such as greenhouse gas emissions, clean water availability, carbon sequestration, biodiversity and the dispersal of pests, pathogens and weeds.

Therefore, the reduction of use of agrochemicals *per se* is not a condition of SAI, but rather their rational use in conjunction with agroecological practices. Commercial agricultural systems with high productivity based on the use of agrochemicals will need to moderate their use while sustaining productivity through integration of agroecological practices, but low productivity systems may benefit from some use of external inputs together with agroecological practices to increase productivity and improve sustainability. Access to appropriate, quality inputs for producers is a key issue in many African countries, but particularly for smallholders. The complex relationships between intensification and human health should take a position of primary importance in any framework designed to advance food security (Trimmer et al, 2017).

One of the key concerns pertaining to certain technological pathways to intensification (for example, which involve the use of agrochemicals and genetically improved seed) is the power of agro-industrial companies, which is also associated with the consequent development of processing supply chains and channelling increased production to growing urban populations. While agro-industrial companies gain greater power, smallholder bargaining power remains weak. There are thus valid concerns as to how smallholder farmers can engage in technological, agribusiness-involving pathways to intensification and the terms of any incorporation into value chains, given capacity issues and weak bargaining power (Bolwig et al, 2010). The more economically and socially disadvantaged smallholders are, the more challenging it becomes for smallholder farmers to participate through linkages to markets, to capture benefits from their participation in value chains. Further, with processes of commercialisation in agriculture there are risks that some marginal groups can be further excluded.

**For proponents, agroecological approaches comprise certain methods but also emphasise, amongst other things, more localised trading relationships anchored in smallholder farming and drawing upon local knowledge.** However, scaling up is the key challenge and requires a supportive enabling environment. For example, Olivier De Schutter<sup>2</sup> (2011) argues that agroecological approaches are the most effective way to facilitate smallholder-social inclusion and are much more likely to secure human rights to food and achieve fully sustainable production, because they tackle the issues of power concentration within agribusiness that result from some forms of technological development and globalising markets. Scaling up is critically important and needs a supportive enabling environment: 'prioritising the procurement of public goods in public spending rather than solely providing input subsidies; investing in knowledge by reinvesting in agricultural research and extension services; investing in forms of social organisation that encourage partnerships, including farmer field schools and farmers' movements innovation networks; investing in agricultural research and extension systems; empowering women; and creating a macro-economic enabling environment, including connecting sustainable farms to fair markets' (De Schutter, 2011). An FAO study recommends steps for the construction of markets for agroecological products (FAO, 2017). Developing what could represent 'sustainable farms' and 'fair markets' in the SSA context requires more research.

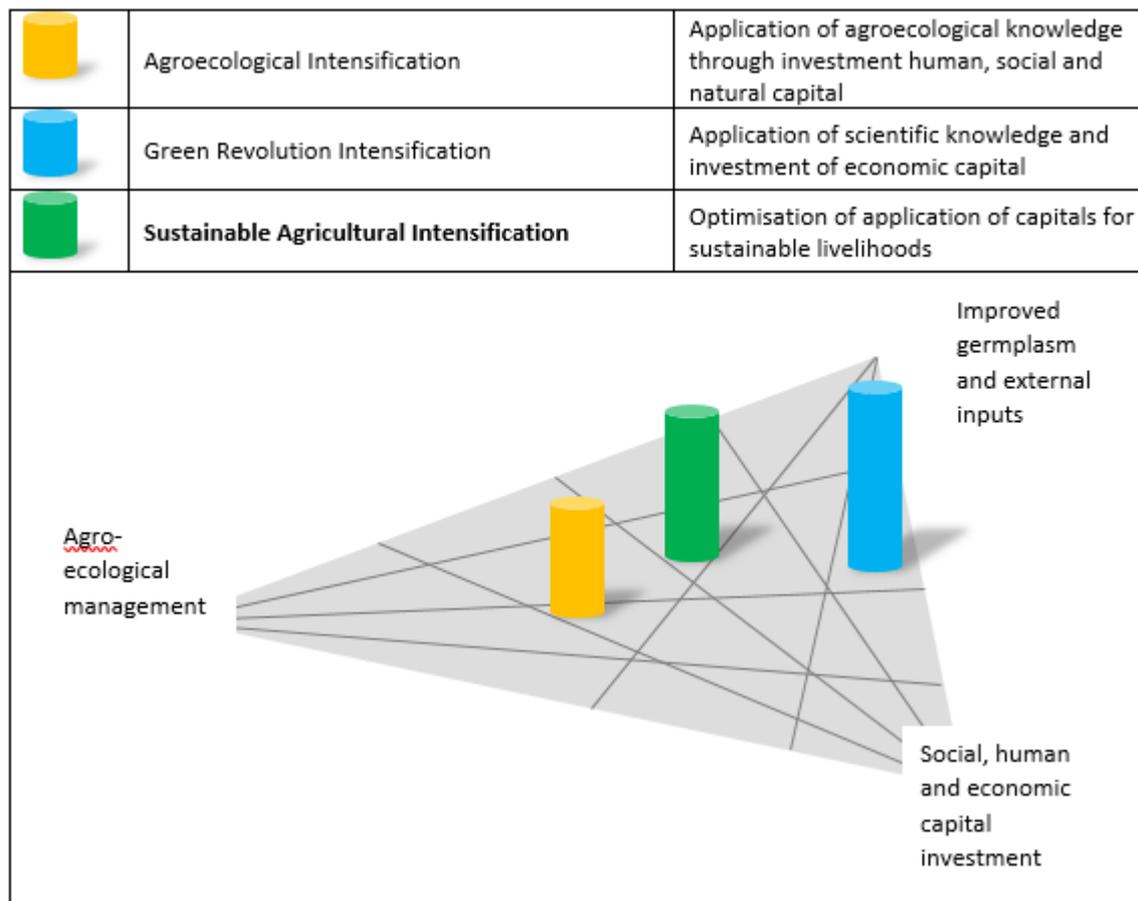
**For some scholars and practitioners, the different pathways to Sustainable Intensification, may not be mutually exclusive, but rather they need to be combined to achieve sustainability and intensification of agriculture.** The Montpellier Panel (2013), a group of European and African experts<sup>3</sup> identified three 'practical approaches' to intensification, namely: i) ecological intensification (agroecological practices); ii) genetic intensification (yields, nutrition and resilience to pests and diseases) and iii) socio-economic intensification (human, social and market capital). These approaches are not seen as mutually exclusive by the Montpellier Panel (2013) - indeed it is the combination of all three that is most likely to enable achievement of SAI. Many observers would link genetic intensification with the use of agrochemical inputs typical of the 'Green Revolution' (Gregory et al 2002). Combining the latter, we might see different agricultural intensification pathways mapped against the application of agroecological, green revolution and socio-economic approaches that they entail, and how each utilises social, human, economic and natural capital (Fig 1).

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<sup>2</sup> The UN Special Rapporteur on the Right to Food

<sup>3</sup> <https://ag4impact.org/montpellier-panel/>

**Figure 1. Pathways of agricultural intensification and the investments they build upon** (Height of the columns gives an indication of likely relative productivity, but not sustainability)



**However, there may be social, environmental and economic trade-offs in combining approaches and depending upon how these approaches are combined that need to be considered.** These trade-offs are at the heart of the perception of agroecological pathways favouring smallholders and genetic/agrochemical intensification pathway as favouring commercial interests. Collier and Dercon (2013) have recognised the contested and polarised nature of many of the preceding debates and call for more 'open-minded approaches to different modes of production'. SAIRLA seeks to promote such open-minded debate.

**Box 3: Improving germplasm: The role of biotechnology vs agrobiodiversity**

Only 20 per cent of farmers in sub-Saharan Africa are believed to use improved seeds, which is considered a significant limitation to increasing productivity. At the same time due to lack of local capacity to develop, reproduce and distribute improved seed, much as been imported but has not been found to be well adapted to African production conditions, particularly those of smallholders. This has led to initiatives such as New Rice for Africa that seeks to combine the improved productivity characteristics of improved Asian rice varieties with the resilience of African rice landraces by breeding hybrids between the two (Montpellier Panel 2013).

Biotechnology encompasses the management of all biological elements of the agricultural system, but has become associated with genetic manipulation of the plants, animals, pests and diseases of the agricultural system. While previously conducted through traditional breeding this can now be accelerated through molecular biology techniques creating Genetically Modified Organisms, a term

that has also become synonymous with transgenic organisms i.e. organisms who have DNA from more than one unrelated species. In this fast-moving field there are now many options to manipulate the DNA of organisms without introducing the DNA of a foreign species – for example, marker selected breeding. At the same time there are even more powerful tools such as gene editing and gene drives that require careful consideration as to the potential impacts of their use (Esvelt & Gemmell 2017).

In summary, biotechnology-based genetic improvement or change, in certain circumstances may provide potential opportunities to address some of the limitations on agricultural productivity and to reduce environmental impacts through the development of greater pest- or disease-resistance in crops. Nevertheless, environmental, social, and economic impacts and the associated trade-offs and equity implications relating to such interventions can be complex and need to be understood, as do those of alternative or complementary agroecological approaches. The environmental, social and economic impacts of GMOs is a highly contested field. Recent assessments of the impacts of GMO crops on agro-ecosystem processes indicate that there can be both positive and negative ecological consequences of their use, but that the impacts overall are not different in nature to other changes in agronomic practice (Kolseth et al 2015).

## 7 Conclusion

**Intensification in agriculture is needed in sub-Saharan Africa to address a growing demand for food – how to achieve it is less clear.** Definitions of intensification have evolved, but pathways to the achievement of SAI are highly contested. There are differing technologies, approaches and pathways. Most likely, a combination of approaches in SSA will be required to achieve higher productivity, sustainability and equity. Debates have been highly polarised on the use of certain technologies, and the relative roles of large-scale investments versus smallholder-led development, but in fact more differentiation in policy responses is needed given differing regional trends and possibilities.

**There is greater scope for land transactions so that marginal households can move out of agriculture, allowing the emergent medium-scale enterprises and remaining smallholders to flourish and increasing overall production.** Such a view sees smallholder agriculture as continuing to be a credible policy option, provided that strengthened land tenure security is achieved as a pre-condition for equitable land transactions, followed by support for innovative sustainable business models and as part of a wider package of national development measures.

**Challenges to the growth of agribusiness and a different kind of enabling policy framework and set of institutional frameworks is required according to proponents of agroecological food systems.** The latter argue that only more systemic changes can deliver fully on sustainability issues in the longer term including rights to food and social inclusion. The potential for smallholder-led intensification in land constrained areas is significant, given a fairer enabling environment and appropriate support for scaling and access to 'alternative fair markets', but the extent to which the latter can be viable in practice is unclear.

**Further research must challenge many of the assumptions about agricultural development and take equity issues seriously.** Given the polarised nature of debates to date and the multi-dimensional nature of agricultural decisions from a sustainability perspective, new empirically grounded research will be highly valuable combined with national conversations and learning processes to help inform decision-makers and wider stakeholders.

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