Soils, science and the politics of knowledge: How African smallholder farmers are framed and situated in the global debates on integrated soil fertility management

Oluwatoyin Dare, Kolawole
Okavango Research Institute, University of Botswana
Botswana

Abstract

The paper addresses an important and often overlooked cultural aspect of smallholder agriculture in sub-Saharan Africa (SSA). This relates to how different policy organisations conceptualise soil management problem, its causes and solutions and how these framings intersect with, and incorporate smallholders' indigenous knowledge. The article provides a brief review of the positionality of modernists and post-modernists on knowledge production and the politics which the process entails. Considering the ideology of some continental and global initiatives on integrated soil fertility management (ISFM), the paper identifies and addresses institutional framings of soil fertility problem in SSA. It also analyses the political economy [and ecology] of soil management in SSA; and investigates how farmers' knowledge are incorporated into ISFM in the sub-continent. Drawing from some empirical evidences, the paper suggests that there is need for an economically viable and socio-culturally acceptable framework for the integration of both western and local knowledge in ISFM.

Key-words: Soil, culture, smallholder farmers, politics, knowledge, political economy, global initiatives, Nigeria, sub-Saharan Africa

1.1 Introduction

The importance of soil fertility in food production cannot be over-emphasised. Widely claimed, it is one of the most critical problems now facing agricultural development and food security in the sub-Saharan Africa (SSA) region. Thus, soil management and its attendant problems in SSA have continued to receive attention amongst development experts. Some international initiatives and donor programmes are underway to address the problem of soil fertility decline in the sub-continent.

This paper, therefore, analyses some of these continental and global initiatives and debates on integrated soil fertility management (ISFM) in SSA. In general, it addresses the overarching question of how African smallholder farmers' knowledge in soil management is perceived and situated within different framings of the problem. Essentially, the essay intends to answer specific questions as to what the institutional framings of selected organisations are regarding their perceptions and definitions of SSA soil problems; the nature of the political economy [and ecology] of soil fertility management in the region; and how farmers are mainstreamed in the entire process of problem-solving and knowledge production in soil fertility management, in an attempt to strengthen their [farmers'] knowledge systems.

Using secondary information obtained from archives of relevant institutions, the paper employs a discourse analysis to examine the viewpoints and activities of selected international [policy] institutions working in ISFM in the SSA region. Also, empirical data are used to strengthen the analysis on the smallholder farmer's own culture. Following the introduction, section two addresses the current debates on soil fertility management in SSA. Section three is a brief review of the positionality of the modernists and post-modernists on the politics of knowledge production. In addition, this section also addresses the distinction between local and scientific knowledge. By focussing on how smallholder farmers' knowledge[1] is situated within the global debates on ISFM, section four specifically identifies and addresses institutional framings of soil fertility problem in SSA. It then goes further to analyse the perceived political economy [and ecology] of soil management and further sheds light on how farmers' knowledge are engaged in the process of achieving ISFM in the sub-continent. The concluding section presents a brief summary of the key issues raised in the paper. It then underscores the need for devising an appropriate and practically-oriented framework for the integration of both western and local knowledge in ISFM as well as finding a more suitable platform for the enhancement of farmers' knowledge.

2.1 Critical issues in soil fertility problems in sub-Saharan Africa: Rising to the challenge?

As earlier noted, the decline in soil fertility has been described as one of the most crucial problems facing agricultural development and food security in SSA (Sanchez 2002; Vanlauwe, *et al*. 2006). Comparing them with soils in other continents, problems peculiar to SSA soils are 'nutrient deficiency, low organic matter, moisture stress, and high erodibility' (CIAT/TSBF/ICRAF, 2002). The causes of these associated problems are not far-fetched. As generally believed, continuous cropping without nutrient replacement, overgrazing and other poor management practices (leading to leaching, water evaporation, wind and water erosions) are primarily the causal factors of poor soil condition in the region. Essentially, farmers' effort to engage in a process of soil improvement and productivity is dependent on a number of intervening variables. Being aware of the precarious condition of their farmlands, their perception about the marginal situation in which they find themselves, seeing reasons to effect a change in the face of besieging pressures, and their willingness to invest in labour and capital in soil improvement [in the hope for good returns on investment] may motivate them to embark on an innovative soil improvement process (Kolawole, 2001; Scoones and Toulmin, 1999).

Nonetheless, contrary to Scoones and Toulmin's claim that farmers are not likely to respond to changes informed by soil degradation and nutrient losses except for some perceived economic benefits (1999), their [farmers'] actions are more importantly guided and partly influenced by certain socio-cultural belief systems and the importance attached to land for their survival (Kolawole, 2002). Regardless of the good intentions of external agencies and government institutions to improve his or her soil conditions, little or no desirable result is achieved if the socio-cultural life of the smallholder is not fully taken into consideration. Farmers' preference goes beyond mere economic pressure and demand. The meaning they assign to social phenomena around them and their perception about life itself are crucial in their decision-making processes, including the willingness to improve on soil conditions. For instance, a South African community believes that soil degradation [in form of erosion] is an act of God to which nothing could be done (Cartier and Graaff ,1998 in Kolawole, 2002)! In North-central Nigeria, certain folks would also have nothing to do with inorganic fertiliser as they strongly believe that incorporating any 'foreign' materials into their soil would jeopardise its health and of course, bumper harvests (Kolawole, 2006). Elsewhere in Ghana, a small farmer's perception about the role of culture in farming activities supports the above claim. The Ghanaian farmer said that the viewpoints of 'his Ancestors' on any agricultural technology [seen as economically superior to local technologies] automatically supersede any economic gains. Without mincing words, he said '[i]n no way would he compromise his Ancestors for an increase in productivity, no matter how great the increase' (Millar, 2007).

In order to further verify the validity of this argument, we held a focus group discussion with some yam-producing smallholder farmers in *Iwara* and *Ilosi* communities in South-western Nigeria in early February 2009. Asked how appropriate the use of inorganic fertilisers in soil management was, they perceived the use of chemical fertilisers in the production of certain crops [particularly yam and other root tubers] to be grossly inadequate and ineffective. Although farmers acknowledged that yam tubers grown under such conditions are most of the time bigger in size, this translates to little or nothing in their thinking if the yam taste is bad and its shelf life is short. In other words, apart from the farmers' notion that chemical fertilisers are dangerous to the health of soil microbes, they (farmers) generally believe that growing yam with chemical fertilisers has adverse effects on yam tuber preservation and its taste as well. Noted for their preference for pounded-yam as a prestigious and culturally popular delicacy, the farmers would

discountenance yam grown with inorganic fertiliser because 'the colour of pounded yam made from such tubers turns dark as against its normal white or yellow colour'.

A good case study showing the interplay between culture, soil fertility and agricultural production is also captured in Kolawole and Okorie's (2008) work on the new yam festival of the *Igbo* people of south-eastern Nigeria thus:

> [T]he earth goddess, *Njoku-ji*, is to *Igbo* people what the queen of heaven is to the Jews with regard to their agricultural production. Failure to appease the earth goddess, the *Igbo* people believe, would engender death, sickness, famine and poverty. *Igbo* people strongly believe that yam [just like any other crop] is under the direct control of the earth goddess, *Njoku-ji*... [T]he rituals involved in the New Yam festival are meant to express the community appreciation to the earth goddess for making the harvest of new yam possible. During the [annual] ceremony, blessing is sought of the earth goddess... A respondent had this to say in respect of the utterances for the ritual: Eat this kolanut (Sic) [pointing the kola nut to the goddess shrine] and help the yam in the small farms such that if the rains be too much, they may not drown and if the rain be too scanty, it may not cause them to wither... (see also Achebe, 1958: 22).

The above account [similar to what obtains in the *Goemai* land of Plateau state in north-central Nigeria] about the need to appease the gods in return for bumper harvest (Kolawole, 1990) strongly attests to the role of culture in soil fertility management and agricultural production in SSA. Regardless of what the development agent brings, certain folks would still find some solace in their ancestors and gods. Ultimately, any outsider's solution is secondary to their firm belief. Given that culture - the totality of the way of life of a people, which is 'acquired, learnt and constructed' (Rapport and Overing, 2007:109) – is fluid and subject to [social, economic, technological, etc.] change over time in the face of modernisation, certain philosophies, norms and belief systems of local community people are hard to break. In other words, while the material dimension of culture is somewhat dynamic, its non-material aspect is somewhat rigid and difficult to alter. It takes a great effort and education (in this case, non-formal) to alter certain ideas, which are culturally imbibed over time by the people. But this is achievable in an atmosphere of mutual trust and respect. More importantly, a genuine starting point for any meaningful institution-clientele partnership is a good understanding [from the on-set] of the dynamics of the elements and processes of the farming community (see Loomis and Beegle, 1975). The ability of the change agency to arm itself with the cultural knowledge of the clientele system thus forms a basis for initiating a collaborative development agenda, which is devoid of suspicion in problem solving activities. Identifying discrepancies and probing (soil) problems through participatory approaches (see for instance, Chambers, 1994), analysing the problem and jointly working through it is enhanced where farmers' participation are 'active' and 'interactive/empowering' (see Agarwal, 2001), rigorously mobilised and sincerely acknowledged

for their contributory role in problem identification, analysis and solving. Taking these viewpoints into account in the midst of immanent and or planned change and finding ways to surmount certain 'fatalistic' dispositions amongst peasants is crucial for development. Recognising, at the same time, their strength in the entire development process is vital for any meaningful outcome. In other words, all hope is not lost if only sincere efforts are geared towards context-specific functional education for the grassroots people. This might go a long way in correcting certain 'erroneous' belief systems of the clientele.

The call for an ISFM under the series of soil fertility initiatives (SFI) already put in place by relevant agencies is a giant stride in agricultural development. ISFM is conceived to mean 'the adoption of a holistic approach to research on soil fertility that embraces the full range of driving factors and consequences – biological, physical, chemical, social, economic and political – of soil degradation…' (CIAT/TSBF/ICRAF 2002). Better put, ISFM is an all round technique, which seeks a balance between the bio-physical and chemical aspects of soil and water conservation as well as nutrient enhancement through the blending of organic and inorganic fertilisers application (Heerink, 2005; Sanders, 2002). As such, particular attention is only paid to the socio-economic and political dimensions of soil fertility management. Nonetheless, cultural factor, which is missing in the above definition, has been emphasised elsewhere as an important part of the approach (TSBF-CIAT, 2005).

2.1.1 The peculiarity of Africa's soils

Africa is claimed to be the world's oldest land mass, and its soils (derived from ancient granite rocks) show its age (AGRA, 2008; 2009). As it obtains elsewhere, soil formation [through rock weathering] is influenced by a number of factors. These range from physical to biological and chemical agents. The interplay between the agents of weathering is in turn influenced by the ecological conditions of a particular locality. Admittedly, the SSA region is known for its diverse agro-ecological conditions. The variations are noticeable right from the dry Sahel in North Africa through the Sudan and Guinea savannas, to the humid rainforests as well as the mangroves found along the coastline of West Africa, and down to the Kalahari Desert in Southern Africa. These ecological variations affect the rate and type of soil formation in the various zones. They also play an important role in the nature and peculiarities of soil fertility problems in specific contexts (locales). By implication, they are in turn directly linked with the political ecology of soil management in those contexts. This shall be revisited later in section four of the paper.

By and large, African soil groups (as shown in Figure 1) are in the forms of desert; poorly developed sand; Mediterranean; *Luvisols; Luvisols* and *Acrisols*; *Nitrosols* and *Acrisols*; and *Ferrasols* and Lateritic soils (Scoones and Toulmin, 1999). More importantly, the nature of intensive soil tillage and the peculiarity of tropical soils affect the level of nutrient availability. Essentially, soil systems consist of four major contents: the mineral elements; water; air; and organic materials (Uphoff *et al*., 2006). Seen as necessary requirements for plant growth, any alteration in these constituent parts makes the soil less productive. The SSA is noted for its problem of soil erosion (Scoones *et al*., 1996), thus, constituting a major impediment to agricultural productivity in the sub-continent. Soil erosion occurs when plant nutrients are either swept/washed away by the wind or water. Thus, Africa's soils are claimed to be '…low in nutrients, low in organic matter and have poor water holding capacity' (AGRA, 2008; 2009). It is also acknowledged that tropical soils are noted for their low *cation* exchange capacity[2] (CEC), which constitutes a serious barrier to plant nutrient uptake even where inorganic mineralisation has been effectively carried out (Scoones and Toulmin, 1999). Although, the CEC of the soil could be enhanced '…using organic materials, such as manure and crop residues, it is difficult to achieve such improvements in organic content in lowland conditions' (van der Pol, 1992 in Scoones and Toulmin, 1999). Soil fertility thus appears to be a difficult concept to define. There are many definitions as to what soil fertility might mean. For instance, while van Reuler and Prigs in Scoones and Toulmin (1999) define it as the capacity of the soil to provide plant nutrients, water and oxygen (1993), Finck writes that it is a complex term with many components such as soil depth, texture and structure (pore space for supply of oxygen and water), soil reaction, humus content and composition, activity of soil organisms, nutrient content, storage capacity for nutrients, content or absence of detrimental or toxic substances (1993).

FIGURE 1 HERE

The importance of organic manure and its application in the context of the Africa's soil is resonated in the foregoing claims. Given that smallholder farmers have traditional ways of enhancing soil fertility and conservation through organic *manuring*, shifting cultivation, bush fallow, bush slashing and burning, mulching, stone *bunding*, vertical ridging, etc. (see for instance, Asrat, *et al.,* 1996; Kolawole, 2002), farmers' knowledge in soil fertility management then becomes a subject of interest in this write-up. Although most of these practices (e.g. shifting cultivation and fallow) can no longer be used exclusively in many contemporary societies due to the demand on land as warranted by industrialisation and population pressures, the application of

some of them (e.g. manuring, mulching, etc.) is still plausible when combined with western approach to soil fertility management. This shall also be revisited later in section four.

Scoones and Toulmin have identified some interventionist strategies in implementing policies for soil fertility management in Africa. They include soil recapitalisation; adoption of high external input (HEI) - fertilisers; low external input (LEI) agriculture (organic *manuring*); and ISFM (1999). Nonetheless, for western science to play a significant role in SSA soil replenishment, farmers' ideas in 'technological choices' are needed. For instance, rather than lay too much emphasis on the combination of HEI and organic matter, finding a suitable approach to soil recapitalisation is, perhaps, more desirable. The combination of organic matter and rock phosphates, which are locally available in SSA countries (Mokwunye *et al.*, 1996 in Scoones and Toulmin, 1999), may be a turning point in revamping Africa's soil. But then, the use of rock phosphates is said to be fraught with many problems. These include the possibility of working with low reactivity rock phosphate (as found in Burkina Faso), leading to uncertainties in economic viability of investing in such ventures; high transportation costs (as obtainable in western Kenya); environmental and health hazards associated with it in a situation where too many dusts are produced; etc. (Scoones and Toulmin, 1999). Agreed that these problems (although not entirely general) may have constituted an impediment to soil recapitalisation, appropriate strategies could be devised to substantially address the challenges. Indeed, the public-private partnership (PPP) effort is crucial here. The investment drive informed by cost minimisation and profit maximisation of private concerns put them in a better position to complement pubic organisations in a bid to effectively manage common resources. Interestingly, numerous public and private efforts are now under way to address soil degradation problems in the sub-continent, some with substantial institutional, financial and technical resources behind them. These initiatives[3] shall be identified in the following sub-section and later revisited in section four of the paper.

2.1.2 Trends and initiatives in soil fertility management in sub-Saharan Africa

Vanlauwe, *et al.* (2006) vividly capture the series of paradigm change, which soil fertility management research and development efforts in SSA have undergone from 1960 to date. The soil fertility management paradigm of 1960s and 1970s placed emphasis on external input but with little or no significant recognition accorded the role of organic resources. The paradigm of the 1980s addressed the biological management of soil fertility as part of LEI sustainable agriculture. Here, organic matter was perceived as a main source of plant nutrients. Pedro

Sanchez's 1994 alternative, second paradigm for tropical soil fertility research and remediation advocated for a combination of organic resources and inorganic fertiliser (Sanchez 1994). This paradigm held that organic matter served other complimentary roles in addition to supplying plant nutrients. Today, the ISFM paradigm (seen as a part of integrated natural resource management, INRM) holds sway. In ISFM, many stakeholders' interests having social, economic and political underpinnings are said to be paramount.

Central to this work, therefore, are the on-going soil fertility debates and efforts amongst some selected organisations whose current interests are in ISFM in SSA. These organisations/agencies include the Soil Fertility Consortium for Southern Africa (SOFECSA), International Centre for Agro-forestry Research (ICRAF) also known as World Agroforestry Centre (WAC); Consultative Group on International Agricultural Research (CGIAR) and the World Bank SFI for Africa; African Network for Tropical Soil Biology and Fertility (AfNet-TSBF) of the International Centre for Tropical Agriculture (CIAT); Gates and Rockefeller Foundations-Alliance for a Green Revolution in Africa (AGRA); the African Millennium Villages Project (MVP); and the Comprehensive Africa Agriculture Development Programme (CAADP) of the New Partnership for Africa's Development (NEPAD).

Indeed, both ICRAF and TSBF-CIAT have, in the recent times, joined forces to challenge the problem of soil fertility management in SSA. Acting in the capacity of a private philanthropic institution, the Bill and Melinda Gates Foundation's new initiative on agriculture is commendable. It has committed about $350 million so far to '…radically boost farm productivity in sub-Saharan Africa and South Asia in a short time by introducing new seed varieties, irrigation, fertilizer, training for farmers and access to local and international markets' (Heim, 2008). In spite of this seemingly lofty effort, the initiative has met with popular resistance as people believe that it is market-oriented and technology-driven in favour of certain interest groups in the West. Of interest, too, is the recent initiative on soil conservation by the AGRA. Through the assistance of the Gates and Rockefeller Foundations, a huge sum of money is already being ear-marked for its soil health initiative in SSA also under its African Green Revolution programme. Although emphasising the need for an integrated soil management with consideration for farmers' knowledge and environmental sustainability, the pathway, which AGRA intends to follow (in terms of policy framework and implementation) is, however, still remains unclear (Scoones, 2008). In all of this, it is important to ascertain the specific roles played by farmers in ISFM. The following section shall be devoted to the debate on [western and local] knowledge production.

3.1 Post-modernism and the politics of knowledge

There has been a renewed thinking amongst *knowledge industrialists* on the need for an eclectic approach to knowledge production. Deborah Eade had reported Cline-Cole (2006) that knowledge processes cannot be divorced from "the complex and diverse 'lived contexts' in which they are generated – in people's homes and communities, rather than in academic ivory towers or the offices of development experts" (2006). Perhaps, the renaissance of postmodernist thinkers appears to be one of the best things that have happened to academic discourses and fervour in the recent times. Post-modernism was originally rooted in the French thought in the late 1960s and early 1970s[4]. Nonetheless, '[s]ensitized by the insights of some of the classic thinkers[5]… postmodernist thought emerged with a new intensity in the late 1980s and early 1990s' (Milovanovic, 1997). Thus, one major pre-occupation of post-modernist scholars, among others, has been the celebration [and perhaps an attempted valorisation[6]] of local knowledge. Rather than see knowledge as: global; dominant discourse of the master and University; Truth; absolute postulates; deductive logic; closure-depicted – 'stored passively as in a banking education', to list a few - as claimed by their modernist counterparts (Milovanovic, 1997), the postmodernists have been emphatic that: knowledge is local; fragmented; partial; contingent and provisional truths; discourse of hysteric and analyst; meta-narratives; heard within repressed voices; article for sale, produced in multiple sites; relational and positional; intricately connected and hierarchically arranged with power; etc. (Olukoshi, 2006; Kerruish, 1991; Sarup, 1989; Dews, 1987; Lyotard, 1987 and 1984; Geertz, 1983; Foucault, 1980 and 1973; Pitkin, 1971; Godel, 1962).

Although not the pre-occupation of this paper, it is noteworthy that postmodernists have been sympathetically feministic as well. The main thrust of this write-up is thus rooted in Gödel's undecidability theorem (1962), which is of the notion that there are many truths without any possible 'over-encompassing Truth' and that local knowledge(s) is/are not necessarily subsumable under one grand narrative or logic. If this is true, it may be a worthwhile endeavour to know what exactly has been happening in the spheres of local knowledge production *vis a vis* the modernists' positionality on the authenticity and absoluteness of dominant or global [westernised] knowledge. Perceived as a threat to the latter, Milovanovic (1997) comments on local knowledge (LK) and the attrition between it and global knowledge:

> Dominant and global knowledge always subverts voices that otherwise seek expression, either directly or indirectly; by the demand that all desire must be embodied within dominant concepts, signifiers, and linguistic systems, or by way of translation (intertextuality) from their more unique concrete form into abstract categories of law and bureaucracy… Postmodernists view subjects within a social formation as thwarted in their attempts to be true to their desires. Even so, 'space' does exist for possible articulation of desire. The

> destabilizing effects of *noise, the parasite, the work of the rhizome, minor literatures, the nonlinear disruptions of enthymemes, and the subversive writerly* (Sic) *texts* [my emphasis] always threaten dominant forms of knowledge.

The power relations amongst actors and between these two bodies of knowledge thus become apparent here. Who and what determines what is acceptable as a universal knowledge? What makes an exposition or discovery 'scientific' or otherwise? In what context is a body of knowledge perceived as a science or non-science? These are some of the contentious issues in the political frontiers of power relations amongst knowledge producers. Robert Chambers had discountenanced the attitudes of the critical and cynical academics and social scientists whose pre-occupation, by virtue of their trainings, is to find faults, which invariably affects their views about what exists beyond their world (1983: 31-32). Even the average African scientist does not see the need to put emphasis on LK at a time when everything has to be 'modern'. To them, whoever pushes for local people's knowledge is anti-development. Hence, the foregoing serves as the point of departure and or basis for this paper. To the modernists, LK is not systematic and organised: '[w]hereas scientific knowledge tends towards closure, narrative knowledge embraces imaginary free play' (Milovanovic, 1997). Also to these scholars, entrenching 'Absolute Postulates from which all other "facts" can be explained by linear, deductive logic' must and should be the ideal for the production of knowledge (Milovanovic, 1997). In that context then, and through the weapon of the powerful, LK may not thrive.

Nonetheless, regardless of the views of the modernist thinkers, LK, otherwise known as indigenous knowledge (IK), has been seen by the postmodernists as all-encompassing; it cuts across all sectors such as agriculture, medicine, technology, climatology, conflict management, forestry, etc. Amongst grassroots people, LK forms the basis for local level decision-making in agriculture, ethno-medicine, ethno-veterinary medicine, and in other rural livelihoods in the South and perhaps, elsewhere. Towards the end of the twentieth century, there was, thus, the growing awareness among stakeholders that IK was crucial for any form of discussions on sustainable resource use and balanced development (Brokensha *et al.,* 1980; Warren, 1990). But then, Mike Powell has queried: 'Do development organisations really understand the historical realities of the societies that they exist to change? Or '…how much do they understand of the perceptions of those realities by the people upon whom all development interventions ultimately depend…?' (2006). Perhaps, some of the relatively new efforts initiated [by development practitioners] to take care of those anxieties expressed by scholars like Powell are the participatory methodological tools[7] now wielded by researchers in the process of doing development business. Thus, the era of transformative approaches to agricultural research and

development has had a long history. As outlined by Scoones *et al*. (2008), the sequence came in the forms of Training of Trainers [ToT] (since 1960s); Farming Systems Research (FSR) [1970s and 1980s]; Farmer First/ Farmer Participatory Research (FPR) [from 1990s]; and Participatory Learning and Action (PLA) [which came to the fore in 2000s].

Indeed, typologies of FPR have been developed based on the objectives of research and the organisational and managerial arrangements for implementation; and levels and forms of farmer engagement (Rusike *et al*., 2006; Biggs, 1989; Pretty *et al*., 1995). However, Scoones and Thompson (1994) affirm: '…there is now an increasing recognition of farmers' own research and experimental investigation', the extent to which those farmer-led typologies have indeed empowered the smallholder farmer remains doubtful. Reflecting on the future of FPR in the CGIAR, Fujisaka (1991) was of the opinion that farmer participation continued and would continue to be needed at the Consultative Group centres in natural resource conservation and management amongst others. Even so, it appears LK has continued to suffer a set-back in the face of the burgeoning modern technologies, which seem to continue to weaken the processes of LK production. Little surprise then that Fujisaka notes that '[o]ur experience with NARS... has revealed a general reluctance to involve farmers until technologies are 'proven" (1991). This is said to partly reflect in the dominant 'top-down' approaches of on-station testing of agricultural research amongst International Rice Research Institute (IRRI) partners instead of '...involving farmers as research partners from the on-set of research' (Fujisaka and Garrity, 1991 in Fujisaka, 1991). Apparently, the much talked about change in paradigm in knowledge production [about the need for openness and reflexivity] amongst Participatory Methodologies (PM) experts is still unclear. The challenges posed by '[c]onventional educational systems and professional hierarchies often do not value such qualities and so do not encourage' (Scoones *et al*. 1994) any *unconventional* approach perceived as 'subversive and undermining' the conventional approach.

Although seen as belonging to the mainstream in today's world, alternative initiatives are met with a brick-wall in the 'entrenched hierarchies and long institutionalised practices…' (Scoones *et al.*,1994). A clear example is Shambu Prasad's and Norman Uphoff's insights on the *System of Rice Intensification* where 'non-conventional skill and practice-based management approach to increasing rice production, particularly in marginal areas…' had recorded great successes but was '…regarded by some as illegitimate and unproven, and so rejected by some mainstream science organisations' (Scoones *et al*., 1994). Another example is the seeming disdain shown amongst scientists towards certain organic agriculture innovations developed and deployed by the Catholic church Rural Development Programme (RUDEP) – a faith-based rural development

organisation in *Oyo* and *Osogbo* area in South-western Nigeria. Among other innovations, Siam weed (*Chromolaena odorata sp.*) soap solution was 'prepared, tested and found to be effective...' in curing black pod disease of cocoa (Alao, 2008). Nonetheless, the claim was rebuffed by one agronomist who rejoined: 'We need scientific research backing or publications to affirm... Siam Soap Solution can replace *long tested fungicides and pesticides developed by scientists and notable chemical companies*...' [emphasis mine] (Oduntan, 2008).

It thus becomes a problem to the extent that the custodians of LK (the native philosophers, farmers, artisans, etc.) are still not, to a large extent, given the required voice and recognition in the process of initiating and implementing agricultural research. Regrettably, the domineering and all-pervasive *modernist* project in food and agricultural policy has not provided any meaningful benefit for the poor people in the South economies (see Thompson, *et al.*, 2007). The following sub-section shall highlight the features of both local and western knowledge.

3.1.1 Between farmers' knowledge and scientific knowledge

In the academic parlance, post-modernist thought has played a significant role in the knowledge debates. The concept of knowledge is thus complex and as such cannot be understood through some simplistic definitions. Scoones and Thompson (1994) affirmed that '[e]very system of knowledge…has its own epistemology, its own theory of what constitutes and what counts as knowledge'. Knowledge production entails the interplay between what is outside and what is inside of us. It suggests self-awareness about 'our own predispositions to select, interpret and frame' (Chambers, 2005). Nonetheless, different backgrounds and trainings do influence the different ways people/scientists/academics see things even when they view a phenomenon from the same point of reference. '[S]cience is, [therefore], ideological and value laden…' (Kuhn, 1962, in Sumner and Tribe, 2008: 53-54). Thus, Foucault (1980: 82) had delineated between two forms of knowledge as they had been generally perceived: *erudite knowledge* (scientific) and *local popular knowledge* (without a common meaning; unscientific).

Contrary to Agrawal's view that western knowledge (WK) and LK are the same (1995), some scholars have conceived LK as different from the scientific or western knowledge systems (WKS) on substantive, methodological or epistemological and contextual grounds (see for instance, Banuri and Apffel-Marglin 1993; Dei 1993). Indeed, western science is pre-occupied with the way of knowing. This is portrayed in such concepts as ontology (investigating the nature of 'reality'); epistemology (finding ways to know 'reality'); theory (the basic assumptions about the

inter-relationships between phenomena subject to being investigated); methodology (focusing on the strategy behind the choice of methods); and methods (paying attention to what techniques are used in gathering and analysing data) (e.g. Sumner and Tribe, 2008: 53-55). On the other hand, LK (employing cognitive mapping and validation), albeit without basic codification, focuses on practical problem-solving techniques based on interaction with the bio-physical environment through some years of constant and non-formal observation, experimentation and validation of events (Kolawole, 2001). The commonalities between WK and LK systems are that both approaches follow a procedure of observation, experimentation and validation. But then, while WK production processes consciously and religiously follow these procedures in a formal and regulated environment, LK cannot claim the same 'thoroughness' and 'exactness'.

Given that both knowledge systems seemingly follow the same pattern of procedure in any development-oriented endeavours, including soil fertility management, it is then safe to infer that farmers' knowledge(s) are also 'scientific' (see Millar, 1994) and less inferior to western science. At best, '[t]he two types of knowledge are complimentary' (Richards, 1985: 149). Ultimately, they both can achieve what individually they cannot achieve singly or in isolation (Chambers, 1983: 101). Thus, it is instructive to note that farmers have been found to have a wealth of knowledge yet unsurpassed in many socio-cultural and environmental contexts. For instance, Paul Richards found that contrary to earlier expectations, some students of agriculture in a West African university had a lot to learn from smallholder farmers during their trips on one environmental studies field project in which they had been involved. Rather than propose technical solutions to the environmental problems the farmers were supposedly facing [that was the thrust of the field visits], the students came away with '…farmers' advice on problems they had come across in the course of experiments on the college farm' (1985: 9)! The following section is dedicated to probing the framings of selected policy initiatives - whether or not they intersect with, and incorporates farmers' knowledge in ISFM.

4.1 Small farmers' knowledge and global debates and initiatives on ISFM in sub-Saharan Africa

Central to this paper is the relevance of smallholder farmers in soil fertility management in the SSA region. As earlier argued, farmers' knowledge systems are rooted in their culture. Thus, cultural factors (as reflected in the traditions of local community people) are an important aspect of ensuring the restoration and enhancement of soil conditions in Africa. The thrust of this paper

is, therefore, about how smallholder farmers are perceived and engaged by research organisations and other development agencies within the regional and global frameworks on ISFM.
Attention is paid on seven organisations and or agencies in this work. There is no special interest in selecting any of them but for their relevant activities in ISFM. The listing is neither exhaustive nor the sequence of arrangement based on the order of their importance. Given the scope of the paper, the number of those chosen is to allow for a fair spread. As earlier indicated, SOFECSA[8], ICRAF[9], AfNet-TSBF of the Institute of CIAT[10], World Bank SFI[11], AGRA[12], MVP[13] and NEPAD-CAADP[14] are analysed.

Overall, all the identified initiatives have a seemingly common goal of revitalising African farm lands in a bid to enhance food security on a sustainable basis. Whether this goal incorporates the fundamental needs of the smallholder is another thing entirely. This shall be discussed in the following sub-sections.

4.1.1 Institutional perceptions and framings of soil fertility management in sub-Saharan Africa

The manners in which individuals perceive issues and assign meaning to (or frame) them are largely influenced by their cultural and or academic backgrounds. Organisational strategies and thrusts, on the other hand, are responsible for the way an agency or organisation perceives phenomena and frame them. Thus, framing and labelling obscure the way 'realities' are perceived. In most cases, they constitute a major impediment to a healthy relationship between development experts/agencies and their clientele systems. Moncrieffe (2007) argues that:

> …as development actors, we invariably bring our own mindsets/frameworks, which inform how we interpret and work within different contexts. We inevitably make assumptions about individuals and categorize and label them based on our own socially acquired preferences and perceptions and/or based on the (mis)information we obtain... Where we persist in labelling at a distance, we circumvent the encounters that can potentially challenge our assumptions. Correspondingly, when we are unduly fixed in our assumptions, we may fail to recognize and accept the challenges that encounters (Sic) may bring….

Debates on soil fertility problems may not have been an exception in the above thesis. Of interest here is the way in which problems are perceived. This implies that the method with which a problem is conceptualised will affect the prescription offered to resolve it. There have been various debates regarding the reasons behind the 'backwardness' of SSA region and why it has not been able to adequately feed itself. Poverty and soil degradation are central to these viewpoints. Without any doubt, institutional framings of soil management would directly affect its (institution's) perception of farmers' knowledge and how this is incorporated into ISFM (see

Figure 2 for the summary of framing categorisation). Nevertheless, this paper analyses the various viewpoints of selected initiatives working in ISFM in the region.

FIGURE 2 HERE

Most common reasons adduced for soil infertility in SSA include African farmers' low capacity and lack of resources to invest in soil fertility; socio-economically and bio-physically induced soil problem; farmers' unwholesome soil mining activities; and population pressure. These are mainly points of convergence of the views of various initiatives under analysis. Thus, SOFECSA's (2008) view on African soil infertility is synonymous with lack of farmers' capacities to invest in low external input technology (LEIT). It also affirms that poor adoptions of technologies by small farmers as well as socio-economic and biophysical problems are partly responsible for soil degradation in SSA. Whether they are perceived as either a strength or weakness, SOFECSA, however, fails to identify and underscore cultural factors as an important aspect of soil management. While ICRAF sees the phenomenon as a complex problem, it argues that farmers' lack of resources to invest in soil or knowledge to overcome land degradation as well as his/her inability to replenish soil nutrients after years of continuous cropping are the bane of the African soil. AfNet-TSBF, which also operates on the platform of CGIAR, does not differ in its opinion about SSA farmers, too. On the other hand, while the World Bank SFI believes that farmers lack the resources to invest in land and labour, it also sees a link between soil degradation, population pressure and poverty (World Bank, 2008a). More importantly, SFI's viewpoint on the fact that local communities have an age-long wealth of experience and knowledge in forest, land and water management '…at variable and interacting spatial and temporal levels' (World Bank, 2008b) makes it to stand out amongst other initiatives. What is, however, not clear is SFI's thinking on what has become of those local knowledges. On the other hand, AGRA's position on the African soils is that they are inherently low in nutrients. It also literally frames African small farmers as 'soil miners' so much so that '[t]raditional practices have not been replaced by new methods of soil management and cropping systems due to lack of essential inputs, knowledge and incentives' (AGRA 2008 and 2009; see also Gruhn *et al*., 2000). But then, if farmers were to be truly 'soil miners', they may not have devised resilient means of revamping their soil conditions for a meaningful livelihood. Examples abound amongst farmers in Guinea and Sierra Leone, to mention a few (see Fairhead and Scoones, 2005). The MVP also affirms that soil degradation is mainly due to lack of nutrient replacement after many years of continuous cropping cycles. It does challenge smallholder farmers for their little scope of environmental sustainability, too.

Viewed differently, extensive farming activities, deforestation and overgrazing are seen by NEPAD-CAADP as major causes of African soil depletion.

Overall, the soil mining hypothesis abounds amongst scholars (see Bationo *et al*., 1998; Buresh *et al*., 1997; Cleaver and Schreiber, 1994; Eswaran *et al*., 2001; Gruhn *et al*., 2000; Matlon, 1987; Sanchez *et al*., 1997; Sanders *et al*., 1996; Smaling *et al*., 1997; Steiner, 1996; Stoorvogel and Smaling, 1990; Van der Pol, 1992; World Bank-FAO, 1996). Regardless of the enormity of this claim, there is the possibility of over-generalisation of issues in the debates on soil fertility problems (Scoones and Toulmin 1999: 85). Thus, it is quite erroneous to make sweeping assumptions about farmers and judge them as such knowing full well that there are geographical and other distinctive variations in different contexts within the sub-region. Clearly, examples of how local farmers/communities in Guinea, Cote d'Ivoire, Sierra Leone, etc. show resilience by using age-long contextual strategies for managing natural resources abound (see for instance Fairhead and Scoones, 2005; de Jager, 2005; Fairhead and Leach, 1998). With the exception of the World Bank SFI and AGRA, none of the debates draws attention to the role of culture/traditions in soil management. It appears international development agencies and non-governmental institutions have failed to fully appreciate the importance of traditional roles of local community people in soil management. This failing is considered as a pertinent issue in this paper.

4.1.2 Political economy of soil fertility management in sub-Saharan Africa

The interplay between governance and [the] economic life of any society are not mutually exclusive. How scarce economic resources are managed and allocated is a function of the power relations between and amongst certain political elite. The quality of leadership in any human organisation impacts on how its development is ordered. Like any other initiatives, bureaucracy and organisational efficiency play a vital role in priorities setting in the African agriculture. Achieving a worthwhile economic progress - where resources and agricultural incentives are cornered by the powerful, rent-seeking urban elite at the expense of the poor rural farmers – becomes a daunting task. I shall, in this sub-section, attempt to analyse the viewpoints of the seven organisations/agencies on the political economy and ecology of soil fertility management in SSA.

Common viewpoints amongst all the initiatives on the political economies of SSA countries are poor governance; lopsided and unwholesome policies [both nationally and internationally] on

land management (cf. de Jager, 2005); weak rural institutions and poor infrastructures; and corruption in high places. In SOFESCA's own term, the problem of soil fertility is closely linked with the inability of the governments to create a conducive environment for policy-making, which is meant to provide meaningful solutions to soil infertility. For both ICRAF and AfNet-TSBF, the prevalence of perverse national and global policies on SSA soil problem is a critical challenge. As such, poor price incentives for farmers; land and labour constraints; and weak or lack of rural institutions for support services in the sub-continent (ICRAF, 2008; CIAT 2001) hold sway. The SFI's position is that of an outright weak institutional capacity, which reflects in 'misaligned policies and incentives, unclear property rights and weak enforcement capabilities, often aggravated by corruption and governance problems' (World Bank, 2008b). The inability of farmers to acquire necessary agricultural incentives for investment in soil health either in the short or long-run is also seen by AGRA as prevalent in the sub-continent's agrarian economies. While poor governance is resonate in the view of both the MVP and NEPAD-CAADP, the MVP is more explicit by affirming lack of collateral and high transaction costs and poor infrastructures as major constraints to household-level financing of farm inputs (e.g. fertilisers).

Generally, all the bodies under analysis see a close link between poor governance, weak institutions and poor policies on land management. This is particularly true of the Nigerian situation where the smallholder farmers were sidelined by the state as '… the rent-seeking behaviour of its officials and the bureaucracy truncated the benefits of the Green Revolution to the small farmers. Influential and town-dwelling 'farmers', aristocrats, input contractors and transport owners constituted the unintended beneficiaries of the policies introduced' (Akande, 2005: 176). Corrupt government officials would prefer their rent-seeking cronies in the distribution of farm inputs (e.g. fertilizers and herbicides) and other incentives for agricultural production. These people in turn resell the inputs at exorbitant prices to the hapless indigent farmers. More importantly, ICRAF and CIAT views on international and national hypocrisies on policy formulation and implementation in the enhancement of Africa's agricultural soils call for a serious concern (see Brunsson, 1989: 201-22).

Nonetheless, major overarching problems in these debates are weak institutions and corruption, poor policies, and poor farmer incentives, all of which are a product of poor governance in the SSA region. Closely linked with the foregoing but not directly outlined is the political ecology of soil management in the sub-continent.

4.1.3 Political ecology of soil fertility management

Watts' definition of political ecology amongst an array of others in Robbins' (2006: 6-7) seems most appropriate to this debate. Simply put, it is about understanding '…the complex relations between nature and society through a careful analysis of what one might call the forms of access and control over resources and their implications for environmental health and sustainable livelihoods' (2000). Both politics and economics interact to affect their bio-physical environment. Political ecology thus takes interests in environmental change as warranted by the interplay between politics and the economy. The unequal power relations between the elite and poor and their unequal access to natural resources (e.g. forest and land) constantly generate conflicts amongst and between them. Almost certainly, the current or future bid to invest in rock phosphate might likely generate a new wave of conflict between investors and community people resident in areas where the mineral is found! While, for instance, environmental change such as soil erosion makes some actors wealthier, it further impoverishes others in a 'politicised environment' (Bryant and Bailey, 1997; Blaikie, 1985; Watts and Peet, 2006). Thus, the rise of capitalism and modernity have been associated with environmental degradation as reflected in climate change, soil erosion, etc. for which the poor is largely made to suffer (e.g. Forsyth, 2003). He or she is in turn compelled to further and unconsciously degrade the environment (see also Blaikie and Brookfield, 1987). Piers Blaikie (1985) in Robbins (2006: 53) '…unmasks the oversimplifications of technocratic solutions for complex ecological problems…' as he claims that '…capital accumulation by elite class interests' perpetuates soil erosion in rural areas because such problems are only brought under control if it impinges on capitalists' system of wealth accumulation. In other words, pressing circumstances only compel power brokers to engage in necessary policy reforms and actions. More often than not, policy making and reforms are either influenced by *politics as usual* or as a result of a *crisis situation* (Grindle and Thomas, 1991: 5; see also de Jager, 2005). Laying out the causes and effects of soil erosion in Africa and Asia, Blaikie asserts '…that state policy in the postwar (Sic) development era has made huge withdrawals from the soil bank of the rural poor to serve the interests of wealthier people in distant cities' (1985). Population pressure - as identified by the SFI and CAADP - creates stress on the available natural resources in SSA.

4.1.4 Engaging and incorporating farmers' knowledge in ISFM

As earlier noted, the efficacy of certain LKs cannot be gainsaid. Farmers' knowledge is rooted in their culture. As they have aspirations just like any group of people, farmers have continued to devise resilient strategies for environmental adaptation and other challenges. Smith (1997) notes

that people would naturally control their own lives when there is a reference value (an image of the desired state); a perceptual function (the ability to observe the existing state); a mechanism for making comparisons (the ability to compare the existing state and the desired state for differences); and the ability to act to bring the existing state closer to the desired state. To move from the existing state to the desired state, a mental model, which is a construction in the mind, is used to provide order in the course of taking actions. Outlining the stages of local knowledge utilisation, Kolawole (2001) opines that the *awareness* and *perception* of their precarious farming situations have continued to *motivate* farmers to *evaluate* certain traditional practices developed amongst them, which in turn inform their willingness to either *utilise* or discard a particular knowledge system. Knowing the local community people's dynamics of knowledge production is essential for optimal synergy and healthy relationship amongst development practitioners and local farmers alike. This sub-section is thus devoted to how selected organisations/agencies engage farmers and incorporate their knowledge systems into the mainstream science in finding solutions to land degradation problem in SSA.

With the exception of the MVP and CAADP which see farmers as recipients of knowledge who must be 'coerced' to adopt introduced innovations, other initiatives under analysis seem to agree on the need to recognise and incorporate farmers' knowledge in soil management. In attempting to incorporate farmers' knowledge in ISFM, SOFECSA (2008) promotes 'farmer participatory mode' of agricultural research and development. It also transfers technologies to farmers while at the same time ensuring the improvement of their skills. How this 'participatory mode' is carried out, however, remains nebulous. Whether SOFECSA encourages farmers to lead the entire process or whether it is the other way round is another thing. Apart from this, the characteristics of those technologies introduced to the farmers are important. Whether they are user and environmentally-friendly; complex or simple to understand by the farmers; cost-effective; always available to the users; effective and active in farmers' own terms; etc. remain an entirely different thing altogether. ICRAF, on the other hand, carries out research and development with rural communities and also with due recognition of the indigenous knowledge possessed by those communities. While this is absolutely acceptable, the power relations between ICRAF technical staff and the smallholder farmers are unknown. Who initiates the research agenda, what kind of research is initiated, where it is carried out, and who leads the process remains entirely unclear, too. For AfNet-TSBF, the enhancement of rural innovations is a strategy for incorporating farmers' knowledge. 'Pro-poor participatory approaches that increase the appreciation and use of local knowledge systems in the development of improved soil management interventions and

principles' (CIAT/TSBF/ICRAF, 2002) are said to be employed here. Again, how these participatory approaches are carried out is not explicitly outlined to reflect the true position of the smallholder farmer. The SFI engages its clientele by effecting knowledge sharing and extension amongst technical staff and farmers. It specifically pushes '[t]he incorporation of the farmer innovation approach within a systematic venue…' in soil and water conservation (World Bank 2008b; see also de Jager, 2005). From AGRA's (2009) perspective, increasing farmers' knowledge, investing in capacity building and new technologies, and learning from farmers are avenues through which farmers' knowledge are incorporated into ISFM. Judging from this observation, it appears AGRA recognises the cultural dimension of ISFM as an important aspect in soil management. Although AGRA's first two approaches are interconnected, they smack of the clandestine move by the West to create a market for genetically modified (GM) seeds and other external inputs[15] such as fertilisers and herbicides from *Syngenta* and Monsanto. More importantly, the extent to which learning from farmers by the 'experts' is or will be enhanced is not clearly stated. And legitimising what is learned from farmers (in a formal way) is still not known as well. On request, the MVP trains farmers (through the agricultural extension agents) on 'best' agronomic practices. This appears to be the only avenue for engaging the farmers. Again, no evidence is provided on how and where farmers' knowledge is prioritised in ISFM. Interestingly, it is clear that the MVP's strategy states that its policies/principles (including those on soil management) are guided by '[s]cience and evidence-based, implementing technologies and practices that have already been proven' (Sanchez *et al*., 2008: 4). In other words, any non-conventional skill and practice-based soil management approach, which may have recorded great successes but has remained 'scientifically' unproven is illegitimate and as such cannot be taken seriously (e.g. Scoones and Thompson, 1994). Yet in another twist, the MVP contends that soil fertility depletion is closely linked with '…the breakdown of traditional practices and the low priority given by governments to the rural sector' (Sanchez, 2002). In NEPAD-CAADP's (2002) plan, the emphasis on the engagement of farmers is on making them to adopt sustainable integrated soil fertility, and land and water management practices. The plan also advocates for the use of an admixture of mineral and organic fertilisers in revamping the SSA soil.

On the whole, the analysis above points to four major conclusions. One, farmers' participation in agricultural research and enhancing rural innovations are essential for development. Two, ToT in ISFM is an imperative. Three, improving farmers' skills through training is desirable. Four, learning from farmers through knowledge sharing and extension is plausible for engaging and incorporating LK in ISFM.

5.1 Contrasting views on soil management: Some empirical evidences from Nigeria

In a survey carried out amongst a combined total of 140 smallholder farmers and 100 soil scientists (Kolawole, Quadre and Olorunfemi, Forthcoming; Quadre, 2010; Olorunfemi, 2010) in *Osun* and *Ondo* states, respectively, in south-western Nigeria, respondents were asked to rate a set of statements on how they perceived co-involvement in ISFM on a 5-point Likert scale. Of interest are the findings on some of the ways scientists viewed small farmers. For instance, while 84.0 per cent of the scientists in *Osun* state were of the opinion that "[p]erhaps due to their socio-economic circumstances, small farmers are 'soil miners' who tap resources from the soil and are not willing and ready to replace nutrients back to the soil", 90.0 per cent of the scientists in *Ondo* state were of the same opinion. Nonetheless, majority of the farmers in *Osun* (55.7%) and *Ondo*[16] (45.7%) states had a contrary opinion on this. Whereas majority of the small farmers had a favourable opinion regarding their knowledge level, 80.0 and 76.0 per cents of soil scientists in *Osun* and *Ondo* states, respectively, believed that '[s]mall farmers lack the requisite knowledge of soil fertility management'. Some 92.0 and 50.0 per cents of soil scientists in *Osun* and *Ondo* states, respectively, opined that '[s]cientists have not seen any reasons why they should learn from small farmers,..' Whereas majority of the farmers in *Osun* (68.5%) and *Ondo* (64.3%) were of the opinion that '[s]cientists capitalise on their western knowledge to suppress our knowledge systems', an overwhelming majority of the scientists in both states differed on the farmers' position. Elsewhere, however, scientists in *Osun* (78.0%) and *Ondo* (62.0%) strongly believed that '[t]he western scientists' soil management options are always the best. Hence, farmers need to accept them in good faith'. The analysis of variance (ANOVA) computed in both states showed that there was a significant difference between farmers and scientists' viewpoints on ISFM implementation in the two states. At $P \leq 0.01$ level of significance, there was a significant difference in farmers and scientists' perceptions on ISFM implementation in *Osun* ($F = 434.7$) and *Ondo* ($F = 22.8$) states. Indeed, the analysis shows that there is a wide gap between the perspectives of small farmers and soil scientists on knowledge production in ISFM. Further analyses on farmers' level of soil knowledge were carried out using a set of statements placed on a 5-point Likert rating scale. Such statements include: 'I do not know which fertilisers to use to meet specific needs of crops on my farm'; 'A combination of both organic and inorganic fertilisation is preferable on any given plot'; 'I have had extension trainings on soil management but I still cannot manage the fertility of my farmland'; 'From shared experience, I intend to stick to the soil management knowledge, which I acquired from my forefathers'; etc. The population grand mean plus or minus (±) standard deviation (SD) was used to categorise the farmers based on their individual mean scores. While 18.57 and 61.43 per cents of the farmers in *Osun* state had

high and moderate knowledge levels, respectively, only 20.0 per cent had low level of soil management knowledge (see Figure 3). Analyses also show that farmers in *Ondo* state had low (31.42%), moderate (62.9%) and high (5.68%) level of knowledge in soil fertility management (see Figure 4). Overall, farmers who had a substantial knowledge of soil management in both *Osun* and *Ondo* states accounted for 80.0 and 68.78 per cents of the study population, respectively. Most farmers claimed that they employed traditional anthropogenic approaches (shifting cultivation, fallow, etc.) to replenish and conserve the soil and vegetation. These findings may have challenged the assumptions of soil scientists about farmers' knowledge in soil management (see also Fairhead and Scoones, 2005; Fairhead and Leach, 1998).

FIGURE 3 HERE

FIGURE 4 HERE

6.1 A recap of the key issues raised in the paper

Throughout, this paper exhibits strong sympathy for the relevance of LK utilisation/integration in soil fertility management in SSA. Emphasis on the use of LEIT has been strong in a bid to argue for a sustainable approach towards land management and agricultural production in the sub-region. Essentially, critical issues in soil fertility management in SSA have been highlighted in this essay [Section 2]. The paper also presents the viewpoints of both the modernists and post-modernists on knowledge and the power relations [politics] involved in its production. It then goes further to expose the attritions between local and western or 'scientific' knowledge systems. Distinctions between the two bodies of knowledge are also presented [Section 3]. The exposition then situates small farmers' knowledge in the global debates and initiatives on ISFM in SSA. Putting its searchlight on seven organisations/agencies, it specifically analysed institutional perceptions and framings of soil fertility problems in SSA; political economy and ecology of soil fertility management in the sub-region; and how farmers and their knowledge are engaged and incorporated, respectively, in ISFM initiatives in the sub-continent [Section 4]. In this concluding section, I summarise the critical issues in soil fertility problems in SSA; the positionality of the two schools of thought in the frontiers of knowledge production and then outline the key features of the various positions of the seven initiatives analysed in the paper.

Soil fertility problem is a serious challenge to agricultural productivity in SSA. Soils in the region are noted for their low CEC. And as such, they require a combination of organic and inorganic fertilisation to enhance their capacity for nutrient release. Thus, an array of strategies has been proposed and or implemented to enhance soil fertility improvement in the region. These

include soil recapitalisation; inorganic fertiliser application; organic *manuring*; and ISFM. But then, ISFM has continued to receive enormous attention by several international organisations and other initiatives in the recent times. Perhaps, the contemporary viewpoints on the legitimacy, ubiquity and domains of knowledge might be the beginning of a new era. Thus, the rise of post-modernist thought in the 1960s and 1970s with its renaissance in the late 1980s and early 1990s was a turning point in the knowledge industry. The call for an eclectic approach to knowledge production by the post-modernists was difficult to accept by the modernists whose inherent belief in the way western scientific knowledge is ordered [as opposed to the 'disorganised' and 'incoherent' LK] is sacrosanct. Somehow, there has been an age-long war of attrition between these two bodies of knowledge. The power relations between the two camps suggest a problematic situation. Subversion has been the strategy of the dominant knowledge. Thus, certain farmers' knowledge, although apparently seen as efficacious, have been disdained by scientists because they have not been scientifically tested and proven. But even so, none of the two bodies of knowledge could claim supremacy and monopoly of relevance. As it has been acknowledged, they both would better achieve what they individually cannot achieve in a general term. When farmers' needs are properly taken into account by research institutions, they are more likely to embrace improved and more importantly, appropriate technologies.

Regrettably, however, SSA farmers' capability to adopt improved technologies is seen to be poor. They are seen as lacking producer incentives, which are meant for managing soil resources. Regardless of their resilience in the midst of harsh political, economic, inclement weather conditions and other man-made disasters, SSA farmers have been framed to lack adequate knowledge resources essential for soil management. They have also been labelled as 'soil miners' who draw nutrients from the soil and never to return them back. Yet, local communities have age-long contextual strategies for managing natural resources. But then, how these farmers are well positioned to improve on their age-long approaches is about leadership and 'political will'.

Over all, analysis shows that farmers' participation in agricultural research and the enhancement of rural innovations are seen as essential for sustainable soil management. The ToT in ISFM is considered as an imperative for alleviating the crisis of food insecurity in SSA. Also, improving farmers' skills through training is desirable for capacity development. This enables farmers to better comprehend and utilise improved technologies. Lastly, learning from farmers through knowledge sharing and extension in a mutual environment is plausible for engaging and incorporating LK systems in ISFM.

7.1 Concluding reflections

Indeed, efforts by some global and continental initiatives on ISFM in SSA are underway. What is, however, not clear is the framework for effecting a desirable sustainable soil management in the sub-continent. The much orchestrated participatory mode of involvement (of farmers and other stakeholders) in soil management right from the mid-1980s to the mid-1990s (e.g. Vanlauwe *et al*., 2006) has not yielded many tangible results. Otherwise, the problem would not have persisted till today in the region. The possibility of misjudgment and generalisation on how problems of soil fertility have been construed or perceived in certain quarters cannot be entirely ruled out. It thus becomes absolutely impossible to appreciate farmers' socio-cultural and economic conditions if scientists fail to appreciate the role of culture and belief systems of smallholder farmers within specific contexts in the development process. Without any doubt, farmers are always keen to achieve a desirable quality of life. But strange as it may sound, they place certain cultural values over and above their economic needs. Policies need to pay better attention to this. Again, there is the issue of ethics. Initiatives on soil management that does not give first priority and consideration for the exact and appropriate need of the smallholder farmers may not be worth the effort after all. While it is one thing to involve small farmers in participatory research, it is yet another thing to actually recognise, engage and legitimise their knowledge infrastructures. It is unethical to put development initiatives in place only in the guise of pushing certain technologies that are meant to create an African market for some Western conglomerates at the expense of Africa. It is also difficult to comprehend some of the current debates on soil fertility in SSA if the intensive use of chemical fertilisers is seen as a 'must' in addressing the diverse problems of soil degradation.

Generally, the conceptualisations of soil fertility problems in SSA by most of the initiatives analysed in this paper is that the smallholder farmer [as a result of his or her presumably unwholesome activities – e.g. continuous nutrient mining, lack of capacities to embrace change, overgrazing, etc.] is mainly responsible for soil degradation in the sub-region. Nonetheless, the CGIAR/World Bank SFI, on the contrary, perceives local communities as possessing age-long bodies of knowledge, which they use in preserving the natural resources available to them. Somehow, AGRA recognises this fact, too. As opposed to others, the SFI by design is conceived as a framework or mechanism for stimulating a 'rich debate on sustainable soil fertility and land productivity management in SSA'. Its openness for idea generation on the subject amongst stakeholders [including farmers] may have informed how it partly conceptualises the problem. By and large, the *knowledge industrialists* operating within the spheres of most of the initiatives are,

by virtue of their trainings and academic culture, always too critical without necessarily proffering useful solutions. This is not the only case. Rather than work closely and conscientiously with the farmers, the arm-chair natural scientist is most of the time fully engrossed and pre-occupied with scientific inquiries in a laboratory-container culture where the use of microscopes and chemical reagents is the norm. And this may have largely made him or her not to see beyond his or her immediate academic milieu. He or she, within a different cultural setting, views his or her clientele through a contrived telescopic object. Hence, the labelling and stigmatisation of the smallholder as a major problem behind soil infertility in SSA.

That said, farmers have better knowledge of their farming environment. Unaware, they are good specialists in *pedology* and soil microbiology (see for example, Fairhead and Scoones, 2005). Based on historical trend and experience, they could offer data on soil morphology, flora and fauna. Buttressing SFI's position on the wealth of soil management knowledge possessed by various communities, it is necessary to find a realistic and common ground between western science and farmers' knowledge in order to implement a sustainable soil management program in SSA. Better put, scientists are expected to exhibit some form of cordiality with farmers in a bid to make them (the scientists) more receptive, open and willing to learn new things from the farming clientele. Rather than being presumptuous, scientists must ensure 'a reversal of learning', which is also progressive and rapid; tradeoffs optimisation; biases offsetting; triangulating; and seeking diversity by 'looking and learning from exceptions, oddities, dissenters, and outliers' (see Chambers, 1994) amongst members of the farming community. Of course, they must strive from the on-set to make farmers see reasons why a change program is being introduced. In the process, the smallholders should be given the opportunity to choose carefully between options available to them. In other words, scientists should be willing and eager to carefully point the pros and cons of each option [amongst many pressing demands] to their clientele.

The farmer's field is the best laboratory for experimentation. The transformation of on-farm adaptive research (OFAR) or experimentation (largely initiated and led by scientists) into farmer participatory research (FPR), which recognises farmers as '...central actors in the research and experimentation process' (Scoones and Thompson, 1994), provides a suitable platform for knowledge sharing, adaptation and synthesis amongst the two stakeholders. This forum avails the agricultural scientists the opportunity to better appreciate the process involved in farmers' experimentation procedures and 'mode of enquiry'. Articulating these processes with those of

OFAR engenders a good practice in knowledge production. On the one hand, the researcher's fore-knowledge of farmers' socio-economic and cultural dynamics as informed by earlier investigations/studies is a good starting point in establishing a farmer-scientist's knowledge linkage system. On the other hand, a two-way farmer-extension-scientist information flow and linkage is paramount for generating useful feedbacks in knowledge production. Local farmers engage in curiosity, problem-solving, adaptive and peer pressure experiments (see Millar, 1994). As such, recognising and understanding farmers' own diverse experimentation approaches is vital for researchers if only their engagement with farmers would translate into a productive partnership. The role of extension as the middleman between farmers and researchers prior to, during and after a research initiative cannot be overemphasised in refining the outputs of research in a language and manner that are better appreciated by the end-users. As such, dialogue, trust and mutual respect for and between actors (farmers, researchers and extension personnel) form the basis for both local and western knowledge integration (see Millar, 1994). Identifying and working with farmers who are willing to learn new knowledge and share theirs with others will transform knowledge production in soil fertility management.

Thus, economically viable, socio-culturally acceptable and environmentally friendly alternatives [for soil fertility management] are indeed an imperative. Devising suitable pathways for the implementation of soil recapitalisation and ISFM is appropriate for any quick recovery-intervention. The reinforcement and more integration of leguminous woody and herbaceous plants into existing cropping systems [as part of ISFM] are also considered as one of the best options for the enhancement of soil health. Armed with scientific tools and working in conjunction with local community people, researchers need to empower small farmers to take a meaningful lead in finding suitable solutions to Africa's divergent soil problems.

Endnotes:

1. The term farmers' knowledge is used interchangeably as local or indigenous knowledge throughout in the paper. By its nature, the concept of local knowledge is autochthonous. Admittedly, local knowledge is not mutually exclusive to the South economies; it is pervasive in the local communities of both the West and the South. The age-long tendency of the dominant ['scientific'] knowledge to suppress this body of knowledge sets it apart from the former.

2. The CEC of a soil medium is a measure of its (the soil) ability to retain nutrients. It is the total number of cathode ions or *cations* such as calcium (Ca++), magnesium (Mg++), etc., which a soil is able to hold at any given pH value in relation to the quantity released into soil solution possibly for plant uptake. Exchangeable *cations* such as those held by clay and organic matter particles in soils can be replaced by other *cations* (see for instance, Mengel, 2012).

3. The seven organisations/agencies analysed in this paper are also construed as 'initiatives'.

4. There was a transition from Hegelian to Nietzschean thought as a result of 'the continued disillusionment with conventional critical thought'. Thus, people like 'Deleuze, Guattari, Derrida, Lyotard, Baudriillard, Foucault, Kristeva and many others were to emerge bearing the banner of postmodernist thinking' (Milovanovic, 1997: 2).

5. Examples of these classic thinkers are Karl Marx, Max Weber, Emile Durkheim, Freud, etc.

6. The term 'valorisation' here is conceived to mean 'entrenching' or 'empowering'. By this, I mean placing LK on the proper pedestal by way of democratising its production in Colleges and Universities while at the same time recognising its patency and teaching it [in combination with western science] in the mainstream academia.

7. The development of approaches to farmer participation in agricultural research and extension was largely borne out of the workshop on *Farmers and Agricultural Research: Complimentary Methods* (later known as *Farmer First* workshop), which was held at the Institute of Development Studies in 1987. Examples of such approaches or PMs are Participatory Rural Appraisal (PRA), Participatory Rural Appraisal and Planning (PLAP), Participatory Learning and Action (PLA), Participatory Action Research (PAR), etc. Over the years, Professor Robert Chambers of the Institute of Development Studies (IDS) at the University of Sussex in Brighton has played a leading role in this respect (see for instance, *Ideas for Development*, 2005 and *Rural Development-putting the last first* 1983).

8. SOFECSA is a multi-institutional and interdisciplinary regional organisation founded on 25 May 2005. The initiative was put in place 'to develop and promote technical and institutional innovations that enhance contributions of …ISFM research and development to sustainable food security and livelihood options in Southern Africa' (SOFECSA 2008). Its members include the NARES, international agricultural research centres, universities, private fertiliser and agro-chemical companies as well as NGOs. SOFECSA activities cover four southern African countries of Malawi, Mozambique, Zambia and Zimbabwe.

9. ICRAF also known as WAC, was created to address poverty reduction, food security and the environment through overcoming land depletion in smallholder farms of sub-humid and semi-arid Africa, and searching for alternatives to slash-and-burn agriculture at the margins of the humid tropical forests. These goals are linked with those of the CGIAR (WAC, 2008). In the African region, ICRAF's activities cover East, South, West and Central Africa.

10. AfNet-TSBF Institute of CIAT is the 'single most important implementing agency in Africa. Its main goal is to strengthen and sustain stakeholder capacity to generate, share, and apply knowledge and skills in soil fertility and biology management to contribute to the welfare of farming communities' (CIAT, 2001). AfNet's members include NARES and universities, particularly those working with soil science, agronomy, and technology exchange. Its activities are mainly in Western, Eastern, Central and Southern African regions.

11. The World Bank Soil Fertility Initiatives is a platform for the stimulation of a 'rich debate on sustainable soil fertility and land productivity management in SSA' (World Bank 2008a). Working in about 20 SSA countries, several SFI actions are in the pipeline while some are already being implemented through some funding assistance made jointly or separately by the World Bank and the Global Environment Facility (GEF).

12. AGRA is powered by the Rockefeller and Gates' Foundations. AGRA '…programs develop practical solutions to significantly boost farm productivity and incomes for the poor while safeguarding the environment' (AGRA, 2008). Its activities in 13 African countries focus on eight interconnected areas: seeds, soil health, water, markets, agricultural education, African farmer

knowledge, policies, and monitoring. Although not central to this work, AGRA programmes have been widely criticised as a 'Trojan horse' for genetically modified (GM) seeds, which up to now, have been generally resented in Africa except in South Africa. AGRA 'has also been accused of fronting for seed and fertilizer companies in the West such as *Syngenta* and Monsanto', which are trying to find a platform in the African market (Waithaka, 2008).

13. The MVP is an initiative of the UN, which intends to bring about an integrated approach to rural development influenced by community participation and leadership as a way of tackling the chronic poverty phenomenon in Africa. So far, 78 Millennium Villages projects have been initiated in 12 sites in 10 African countries of Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania and Uganda. Major areas of concern are in agriculture, health, education, infrastructure, water, etc (Sanchez *et al*., 2008). However, documented evidence shows that the MVP is particularly interested in pushing the use of HEI such as improved seeds and fertilisers in its agricultural programme (Sanchez *et al*., 2008: 15).

14. NEPAD-CAADP is a document prepared by the FAO of the UN in conjunction with the NEPAD Steering Committee in 2002 to address food security and agricultural development in SSA. The main thrust of the document/plan is to offer 'guidance to member governments on a wide range of aspects of operationalisation and action to revitalise African agriculture' (NEPAD-CAADP 2002). It thus provides an operational framework that are built on four major pillars addressing: land and water management (Pillar 1); rural infrastructure and trade-related capacities for improved market access (Pillar 2); increasing food supply and reducing hunger (Pillar 3); and agricultural research, technology dissemination and adoption (Pillar 4) (FAO-NEPAD-CAADP, 2002).

15. See J.M. Ssali's (2009) opinion on the feelings of African farmers, environmentalists and NGOs regarding HEI technologies. In the publication, *Big farms may not solve all Africa's agricultural problems*, the Ssali held strong views on the appropriateness of local knowledge and organic farming to boost African agriculture.

16. Please, note that 41.4 per cent of farmers in *Ondo* state had no opinion as to whether they lacked resources, which supposedly influenced them to 'mine' soils.

Acknowledgements

I acknowledge the critical comments and contributions of John Thompson and Ian Scoones, both of the Institute of Development Studies (IDS) at the University of Sussex, Brighton, England. I also thank colleagues for their interest in this paper when it was presented at the conference on *Contested truths: Reshaping and repositioning of politics of knowledge* at the Humboldt-University, Berlin from 16-18 June, 2011. More importantly, I sincerely thank the anonymous reviewers for their useful comments.

References

Achebe, C. 1958. (Reprinted 1985). Things Fall Apart. With Introduction and notes by Aigboje, Igo. Heinemann Educational Books, London.

Agarwal, B. 2001. Participatory exclusions, community forestry and gender: an analysis for South Asian and a conceptual framework. World Development 29(10), 36.

AGRA. 2009. Restoring soil health in Africa, *Alliance for Green Revolution in Africa*. AGRA archive: http://www.aec.msu.edu/fs2/zambia/tour/AGRA_Soil_Health_Programme_Africa.pdf (Accessed 30 January 2012).

AGRA. 2008. Restoring soil health in Africa, *Alliance for Green Revolution in Africa*. AGRA archive: http://www.agra-alliance.org/section/work/soils (Accessed 12 July 2008)

Agrawal, A. 1995. Indigenous and scientific knowledge: some critical comments. Indigenous Knowledge and Development Monitor 3(3), 3-5.

Akande, T. 2005. The role of the State in the Nigerian Green Revolution. In: Djurfeldt, G., Holmen, H., Jirstrom, M., Larsson, R. (Eds.) African food crisis: Lessons from the Asian Green Revolution. CABI Publishing, Wallingford.

Alao, G. 2008. Siam weed: A wonderful plant. *Katolink*. A publication of the Catholic Diocese of Osogbo, Nigeria. May, 3(4), 7.

Asrat, K. Idris, K., Semegn, M. 1996. The 'flexibility' of indigenous soil and water conservation techniques. In Reij, C., Scoones, I., Toulmin, C. (Eds.), Sustaining the soil: Indigenous soil and water conservation in Africa, 164-65. Earthscan Publications, London.

Banuri, T. and Marglin, F. Apffel (eds.) 1993. Who will save the forests? Knowledge; power and environmental destruction. Zed Books, London.

Bationo, A., Lompo, F. Koala, S. 1998. Research on nutrient flows and balances in West Africa: state-of-the-art. Agriculture, Ecosystems and Environment 71, 19-35.

Biggs, S. D. 1989. Resource-poor farmer participation in research: A synthesis of experiences from nine national agricultural research systems. On-farm (Client-oriented) research (OFCOR) comparative study No. 3. International Service for National Agricultural Research (ISNAR), The Hague.

Blaikie, P. 1985. The political economy of soil erosion in developing countries. Longman Scientific and Technical, New York.

Blaikie, Piers M., Brookfield, H**. (**Editors) 1987. Land Degradation and Society. Methuen, London and New York.
:
Brokensha, D., Warren, D., Werner, O. (Eds.) 1980. Indigenous Knowledge Systems and Development. University Press of America, Lanham.

Brunsson, N. 1989. The organization of hypocrisy: talk, decisions and actions in organizations. John Wiley & Sons, Chichester.

Bryant, R., L., Bailey, S. 1997. Third world political ecology. Routledge, London.

Buresh, R. J., Sanchez, P. A., Calhoun, F. (Eds.) 1997. Replenishing Soil Fertility in Africa. Soil Science Society of America Special Publication No. 51. Madison, Wisconsin, USA.

Cartier van Dissel, S. and Graaff Jan. de 1998. Differences between farmers and scientists in the perception of soil erosion. Indigenous Knowledge and Development Monitor 6(3), 8-9.

Chambers, R. 2005. Critical reflections of a development nomad. In: Kothari, U. (Ed.) A radical history of Development Studies. Zed Books, London, 83.

Chambers, R. 1994. Participatory rural appraisal (PRA): analysis of experience. World Development 22(9), 1253-1268.

Chambers, R. 1983. Rural Development: Putting the last first. Longman, Inc., New York.

CIAT 2001. African Network for Soil Biology and Fertility (AfNet). International Centre for Tropical Agriculture. CIAT archive: http://www.ciat.cgiar.org/tsbf_institute/africa.htm#top (Accessed 17 July 2008).

CIAT, TSBF, ICRAF. 2002. Soil fertility degradation in sub-Saharan Africa: Leveraging lasting solutions to a long-term problem. Conclusions from a workshop held at the Rockefeller Foundation Bellagio Study and Conference Centre. March 4-8, 2-4.

Cleaver, K. M., Schreiber, G. A. 1994. Reversing the spiral: the population, agriculture and environment nexus in sub-Saharan Africa. The World Bank, Washington, D.C.

Cline-Cloke, R. 2006. Blazing a trail while lazing around: knowledge processes and wood-fuel paradoxes? Development in Practice 16(6), 545-558

de Jager, A. 2005. Participatory technology, policy and institutional development to address soil fertility degradation in Africa. Land Use Policy 22(1), 61-62.

Dei, G. 1993. Sustainable development in the African context: revisiting some theoretical and methodological issues. African Development 18(2), 97-110.

Derrida, J. 1973. Of Grammatology. John Hopkins Press, Baltimore.

Dews, P. 1987. Logics of disintegration: Post-structuralist thought and the claims of critical theory. Verso, New York.

Eade, D. 2006. Editorial. Development in Practice 16(6), 515.

Eswaran, H., Lal, R., Reich P. F. 2001. Land degradation: an overview. In: Bridges, E. M., Hannam, I. D., Oldeman L. R., Penning de Vries, F. W. T., Scherr, S.J. and Sombatpanit, S. (Eds.) Response to Land Degradation. Enfield, Science Publishers, New Hampshire, USA, 20-35

FAO-NEPAD-CAADP 2002. Comprehensive Africa Agriculture Development Programme. FAO Corporate Repository. FAO: http://www.fao.org/docrep/005/Y6831E/Y6831E00.htm (Accessed 17 July 2008).

Fairhead, J., Leach, M. 1998. Reframing Deforestation: Global Analysis and Local Realities – Cases from West Africa. Routledge, London.

Fairhead, J., Scoones, I. 2005. Local knowledge and the social shaping of soil investments: critical perspectives on the assessment of soil degradation in Africa. Land Use Policy 22 (1), 34.

Finck, A. 1995. From the fertilisation of crops to the management of nutrients in crop rotations and farming systems: an overview. FAO fertiliser and Plant Nutrition Bulletin, 12, FAO, Rome, pp. 67-82.

Forsyth, T. 2003. Critical Political Ecology: The Politics of Environmental Science. Routledge, London.

Foucault, M. 1980. Power/Knowledge: Selected Interviews and Other Writings (Edited by Gordon, C.), The Harvesters Press Limited, Brighton.

Foucault, M. 1973. The Order of Things. Vintage Books, New York.

Fujisaka, S. 1991. Will farmers' participatory research survive in the International Agricultural Research Centres? In: Scoones, I., Thompson, J. (Eds.) Beyond Farmers First: Rural People's Knowledge, Agricultural Research and Extension Practice. Intermediate Technology Publications, Eastbourne, 234-235.

Fujisaka, Sam. and Garrity, D.P. 1991. Farmers and scientists: a joint effort. In: Moldenhauer, W.C., Hudson, N.W., Sheng, T.C., San-Wei Lee (Eds.) Development of Conservation Farming in Hillslopes. Soil and Water Conservation Society. Ankeny, Iowa.

Geertz, C. 1983. Local Knowledge: Further Essays in Interpretive Anthropology. Basic Books, New York.

Godel, K. 1962. On formally undecidable propositions. In: R.B. Braitewaite (Ed.), 'Principia mathematica' and related systems. Basic Books, New York. 173-98.

Grindle, S.M., Thomas, J.W. 1991. Public choices and policy change: The political economy of the reform in Developing countries. The John Hopkins University Press, Baltimore.

Gruhn, P., Goletti, F. and Yudelman, M. 2000. Integrated nutrient management, soil fertility and sustainable agriculture: current issues and future challenges. 2020 Brief 67, IFPRI, pp. 1-2, *On-line document*: http://www.ifpri.org/sites/default/files/publications/brief67.pdf (Accessed on 31 January 2011).

Heerink, N. 2005. Soil fertility decline and economic policy reform in sub-Saharan Africa. Land Use Policy 22(1), 67 – 74.

Heim, K. 2008. Gates Foundation's agriculture aid a hard sell. The Seattle Times, Local news, 20 January. The Seattle Times: http://seattletimes.nwsource.com/html/localnews/2004135235_gatesagriculture200.html?syndication=rss (Accessed on 30 January 2012).

IFAD 2002. Strategy for rural poverty reduction in Western and Central Africa. IFAD: http://www.ifad.org/operations/regional/2002/pa/pa.htm (Accessed 12 July 2008).

Kerruish, V. 1991. Jurisprudence as ideology. Routledge, New York.

Kolawole, O. D. 2006. Local farmers' approach to soil conservation: lessons from Nigeria. Indilinga: African Journal of Indigenous Knowledge Systems 5 (1), 75-86.

Kolawole, O. D. 2002. Factors associated with the utilization of indigenous knowledge systems for soil fertility conservation by farmers in Ekiti State, Nigeria. PhD Thesis, Obafemi Awolowo University, Nigeria.

Kolawole, O. D. 2001. Local knowledge utilization and sustainable rural development in the 21st Century. Indigenous Knowledge and Development Monitor 9(3), 13-15.

Kolawole, O. D. 1990. Sociology of the Goemai, Unpublished Manuscript.

Kolawole, O. D., Okorie V. O. 2008. New yam festival amongst the *Igbo* people of South-eastern Nigeria as a strategy for agricultural extension communication. In: Alao, A. and Babawale, T. (Eds.) Culture and Society in Nigeria: Traditions, Gender Relations and Political Economy. Volume 1. Centre for Black and African Arts and Civilization (CBAAC), Lagos, 363-80.

Kolawole, O.D., Quardre, M.T., Olorunfemi, B. Forthcoming. Whose knowledge counts? Small farmers and scientists' viewpoints on integrated soil fertility management in south-western Nigeria, *Working paper*, Okavango Research Institute, University of Botswana.

Kristi, H. 2008. Gates Foundation's agriculture aid a hard sell. January 20. Seattle Times: http://seattletimes.nwsource.com/html/localnews/2004135235_gatesagriculture200.html?syndication=rss (Accessed 21 May 2008).

Kuhn, T. 1962. The Structure of Scientific Revolutions. University of Chicago Press, Chicago.

Loomis, C.P., Beegle, J.E. 1975. Rural sociology: A strategy for rural change. John Wiley and Sons, New York.

Lyotard, J-F. 1984. The postmodern condition: A report on knowledge. University of Minnesota Press, Minneapolis.

Matlon, P. 1987. The West African semi-arid tropics. In: Mellor, J. W., Delgado, C. L., Blackie, M. J. (Eds.), Accelerating food production in sub-Saharan Africa. Johns Hopkins University Press, Baltimore.

Mengel, D.B. 2012. Fundamentals of soil cation exchange capacity. Agronomy Guide: Purdue University Extension Service, West Lafayette: http://www.ces.purdue.edu/extmedia/AY/AY-238.html (Accessed 24 January 2012).

Millar, D. 2007. Ancestral guidance in Africa's everyday life. Compas: Endogenous development magazine, No. 1, Dec., 4-6.

Millar, D. 1994. Experimenting farmers in northern Ghana. In: Scoones, I., Thompson, J. (Eds.), Beyond farmer first – Rural people's knowledge, agricultural research and extension practice. Intermediate Technology Publications, CPI Anthony Rowe, Eastbourne, 160-165.

Milovanovic, D. 1997. Dueling Paradigms: Modernist v. Postmodernist Thought. Postmodern Criminology. Garland Publishing, New York, 1-11. On-line archive: http://www.soci.niu.edu/~critcrim/papers/drag-pomo.html#bottom (Accessed 19 April 2008).

Mokwunye, A.U., de Jager, A., Smaling, E. (Eds.) 1996. Restoring and Maintaining the Productivity of West African Soils: Key to Sustainable Development. IFDC, Lome.

Mokwunye, A.U., Hammond, L.L. 1992. Myths and science of fertilizer use in the tropics. In: Myths and science of soils of the tropics. SSSA Special Publication, 29. SSSA, Wisconsin.

Moncrieffe, J. 2007. When label stigmatize: encounters with 'street children' and 'restavecs' in Haiti. In: Moncrieffe J., Eyben R. (Eds.), The Power of Labelling. Earthscan, London, 84-85.

Oduntan, J. B. 2008. A point of correction on the issue of Siam weed (*Chromolaena odoratata*). Katolink. A publication of the Catholic Diocese of Osogbo, Nigeria, October, 3(4), 6.

Olorunfemi, B. 2010. Comparative analysis of smallholder farmers and scientists' perceptions of integrated soil fertility management in Ondo state, Nigeria. B. Agric. project, Obafemi Awolowo University, Ile-Ife, Nigeria.

Olukoshi, A. 2006. African scholars and African studies. Development in practice 16(6), 533-542.

Pitkin, H. 1971. Wittgenstein and justice. University of California Press, Berkely.

Powell, M. 2006. Which knowledge? Whose reality? An overview of knowledge used in the development sector. Development in practice 16(6), 518.

Pretty, J.N., Guijt, I., Scoones, I. and Thompson, J. 1995. A trainer's guide to participatory learning and action. IIED Training Materials Series No. 1. IIED, London.

Quardre, M.T. 2010. Comparative analysis of smallholder farmers and scientists' perceptions of integrated soil fertility management in Osun state, Nigeria. B. Agric. project, Obafemi Awolowo University, Ile-Ife, Nigeria.

Rapport, N., Overing, J. 2007. Social and Cultural Anthropology: The Key Concepts. Routledge, London.

Richards, P. 1985., Indigenous Agricultural Revolution: Ecology and Food Production in West Africa. Hutchinson, London.

Robbins, P. 2006. Political Ecology: A Critical Introduction. Blackwell Publishing, Oxford.

Rusike, J., Twomlow, S., Freeman, H.A., Heinrich, G.M. 2006. Does farmer participatory research matter for improved soil fertility technology development and dissemination in Southern Africa? International Journal of Agricultural Sustainability 4(3).

Sanchez, P. A. 2002. Soil fertility and hunger in Africa, Science 295, 2019 – 2020.

Sanchez, P. A. 1994. Tropical soil fertility research: Towards the second paradigm. Transactions of the 15th World Congress of Soil Science, Acapulco, Mexico. Mexican Soil Science Society, Chapingo, Mexico.

Sanchez, P. A., Shepherd K. D., Soule, M. J., Place, F. M., Buresh, R. J., and Izak, A-M. N. 1997. Soil fertility replenishment in Africa: An investment in natural resource capital. In: Buresh, R. J., Sanchez, P.A., Calhoun, F. (Eds.), Replenishing soil fertility in Africa. Soil Science Society of America Special Publication, No. 51, Madison, Wisconsin, 1-46

Sanchez, P. Palm, C. Sachs, J. Denning, G., Flor, R. Harawa, R., Jama, B., Kiflemariam, T., Konecky, B., Kozar, R., Lelerai, E., Malik, A., Mutuo, P., Niang, A., Okoth, H, Place, F., Sachs, S. E., Said, A., Siriri, D., Teklehaimanot, A., Wang, K., Wangila, J., Zamba, C. 2008. The African millennium villages. Consilience: The Journal of Sustainable Development, Issue 1, On-line document: http://consiliencejournal.readux.org/?page_id=17 (Accessed 1 July 2008).

Sanders, J.H. 2002. Agricultural development and poverty reduction in the Sahel. In: Lutz, C. (Ed.), Food Markets and Food Security in West Africa. CDS Research Report No. 15, University of Groningen, Centre for Development Studies, Groningen, The Netherlands, 33–50.

Sarup, M. 1989. Post-structuralism and Postmodernism. University of Georgia Press, Athens, Georgia.

Scoones, I. 2008. Policy frameworks for increasing soil fertility in Africa: debating the alternatives. A Future Agricultures Consortium debate. Future Agricultures: http://www.future-agricultures.org/soilfertility_main.html (Accessed 2 August 2008).

Scoones, I., Thompson, J., Chambers, R. 2008. Farmer first revisited: innovation for agricultural research and development. Workshop Summary, April, 4

Scoones, I., Thompson, J. 1994 (rept. 2007). Introduction. In: Scoones, I., Thompson, J. (Eds.), Beyond farmer first – Rural people's knowledge, agricultural research and extension practice. Intermediate Technology Publications, CPI Anthony Rowe, Eastbourne, 4.

Scoones, I., Reij, C., Toulmin, C. 1996. Sustaining the soil: indigenous soil and water conservation in Africa. In: Reij, C., Scoones, I., Toulmin, C. (Eds.), Sustaining the soil: Indigenous soil and water conservation in Africa. Earthscan Publications Ltd., London, 1, 23-25.

Scoones, I., Thompson, J. 1994 (Reprinted 2007). Knowledge, power, and agriculture – towards a theoretical understanding. In: Scoones, I. Thompson, J. (Eds.), Beyond farmer first. Intermediate Technology Publications, CPI Anthony Rowe, Eastbourne, 7-24.

Scoones, I., Toulmin, C. 1999. Policies for soil fertility management in Africa. A report prepared for the Department for International Development (DfID): 22, 56-81.

Smaling E. M. A., Nandwa, S. M., Janssen B. H. 1997. Soil fertility in Africa is at stake. In: Buresh, R. J., Sanchez, P. A., Calhoun, F. (Eds.), Replenishing soil fertility in Africa. SSSA Spec. Publ. 51. Soil Science Society of America, Madison, Wisconsin.

Smith, L. C. 1997. Introducing MIKS: A methodology for the utilization of indigenous knowledge. Indigenous Knowledge and Development Monitor 5(2), 17-18.

Steiner, K. G. 1996. Causes of soil degradation and development: Approaches to sustainable Soil management. Margraf Verlag, Weikersheim.

SOFECSA 2008. Vision and mission. Soil Fertility Consortium for Southern Africa, SOFECSA: http://sofecsa.org/index.php?option=com_content&task=view&id=24&Itemid=47
(Accessed 17 July 2008).

Ssali, J.M. 2009. Big farms may not solve all Africa's agricultural problems. African Agriculture. Wednesday, February 18, African Agriculture: http://africanagriculture.blogspot.com/2009/02/big-farms-may-not-solve-all-africas.html (Accessed 5 March, 2009).

Stoorvogel, J. J., Smaling, E. M. A. 1990. Assessment of soil nutrient depletion in sub-Saharan Africa 1983-2000, 28.The Winand Staring Centre for Integrated Land, Soil and Water Research (SC-DLO), Wageningen.

Sumner, A., Tribe, M. 2008. International development studies: Theory and methods in research and practice. Sage, London.

The Africa Fertilizer Summit, 2006. Couldn't the world be fed using organic fertilizers? Africa Fertilizer Summit: http://www.africafertilizersummit.org/FAQ.html (Accessed 21 May 2008).

Thompson, J., Millstone, E., Scoones, I., Ely, A., Marshall, F., Shah, E., Stagl, S. 2007. Agri-food system dynamics: Pathways to sustainability in an era of uncertainty. STEPS Working Paper 4. STEPS Centre, Brighton, 1-53.

TSBF-CIAT 2005. TSBF-CIAT's strategy and work plan, 2005-2010. The Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture (TSBF-CIAT): http://www.ciat.cgiar.org/tsbf_institute/pdf/tsbf_ciat_strategy_2005_2010.pdf (Accessed 14 July 2008).

Uphoff, N., Ball, A.S., Fernandes, E. C. M., Herren, H., Husson, O., Palm, C., Pretty, J., Sanginga, N., Thies, J. E. 2006. Understanding the functioning and management of soil systems. In: Uphoff, N., Ball, A.S., Fernandes, E., Herren, H., Husson, O., Laing, M., Palm, C., Pretty, J., Sanchez, P., Sanginga, N., Thies, J. (Eds.), Biological approaches to sustainable soil systems. Taylor & Francis Group, New York, 3-4.

van der Pol, F. 1992. Soil mining: An unseen contributor to farm income in southern Mali. Bulletin no. 325, Royal Tropical Institute, Amsterdam.

Vanlauwe, B., Ramisch, J. J., Sanginga, N. 2006. Integrated soil fertility management in Africa: From knowledge to implementation. In: Uphoff, N., Ball, A.S., Fernandes, E., Herren, H., Husson, O., Laing, M., Palm, C., Pretty, J., Sanchez, P., Sanginga, N., Thies, J. (Eds.), Biological approaches to sustainable soil systems. Taylor & Francis Group, New York, 257 -259.

van Reuler, H.V., Prins, W.H. 1993. Synthesis. In: Reuler, H.V., Prins, W.H. (Eds.), The role of plant nutrients for sustainable food production in sub-Saharan Africa. Vereniging van Kunstmest Producenten, Leidschendam, 18.

Waithaka W. 2008. Kenya: Experts cast doubt on AGRA's soil fertility plan. Business Daily (Nairobi), 18 February, AllAfrica: http://allafrica.com/stories/200802190987.html (Accessed 24 April 2008).

Warren, D. M. 1990. Indigenous knowledge and development. Background paper for seminar presented at the World Bank. World Bank, Washington, D.C., 1.

Watts, M. J. 2000. Political ecology. In: Shepherd, E., Barnes, T. (Eds.), A companion to economic geography. Blackwell Publishers, Malden (MA), 257.

Watts, M., Peet, R. 2006. Liberating political ecology. In: Watts, M., Peet, R. (Eds.), Liberation ecologies: Environment, Development, social movements, (2nd Edition). Routledge, London.

World Agroforestry Centre 2008. Our history: more than 30 years of agroforestry research and development: http://www.worldagroforestrycentre.org/af1/index.php?id=77 (17 July 2008).

World Bank-FAO 1996. Recapitalisation of soil productivity in sub-Saharan Africa. World Bank/FAO, Washington D.C./Rome.

World Bank 2008a. Soil fertility initiative: country action plans. World Bank: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:20442848~isCURL:Y~pagePK:148956~piPK:216618~theSitePK:336682,00.html (Accessed 15 July 2008).

World Bank 2008b. Sustainable land management: challenges to SLM. World Bank: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:21432937~pagePK:210058~piPK:210062~theSitePK:336682,00.html (Accessed 15 July 2008)