

Unpacking the narrative of agricultural innovations as the *sine qua non* of sustainable rural livelihoods in Southern Africa

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Highlights

- There is a strong narrative that perceives agricultural innovations as the *sine qua non* of sustainable rural livelihoods.
- Research and extension efforts should be focused on how innovations are conceptualised, constructed and implemented.
- A social constructivist view on agricultural innovations can help understand the social discourses and how knowledge emerges.

Abstract

There is a strong narrative in southern Africa that posits agricultural innovations as the *sine qua non* of sustainable rural livelihoods. This mantra is based on the belief that the success of the Green Revolution, which lifted millions out of food insecurity in Europe and North America, and later in Asia and South America, should be replicated in Africa. The pervasive food insecurity on the continent is used to justify the narrative. The positivist science and communicative rationality slant of this narrative, overlooks peculiarities of the biophysical and socio-economic aspects of agricultural production in Africa, particularly in smallholder farming systems, which are dominant on the continent. By promoting a de-contextualised account of agricultural production, the narrative distorts the contribution of agriculture to sustainable rural livelihoods. We propose a social constructivist approach to agricultural innovations that is based on a proper contextualisation of the prevailing biophysical and socio-economic conditions, understanding of the dynamics of agricultural innovations, and nature of rural livelihoods in southern Africa.

Keywords: Agricultural innovations; Narrative; Agriculture-based livelihoods; Social constructivism; Sustainable rural livelihoods southern Africa

1. Introduction

On the African continent, including southern Africa, there is a strong narrative that posits agricultural innovations as the *sine qua non* of sustainable rural livelihoods (Tomich et al., 2019). This mantra is based on the belief that the Green Revolution, which first succeeded in Europe and North America

due to advances in agricultural science and technology, and spread to Asia and South America and lifted millions out of food insecurity (Armanda et al., 2019), should be replicated in Africa, including southern Africa (Dawson et al., 2016). This explains research and extension efforts on the African continent that bear three pillars of the Green Revolution trademark, that include: breeding and growing of high-yield hybrids (HYVs); efficient and timely provision of crop inputs (artificial fertilisers, pesticides and irrigation water); and matching crops to favourable agroclimatic areas (Danielsen et al., 2019). There are also similar efforts in the livestock sub-sector.

This cocktail of factors hardly exists in many locations of Africa, which explains why the Green Revolution failed to take off on the continent (Conway and Barbier, 1998). Calls have also been made to search for a 'second Green Revolution', which makes it possible to grow crops under less favourable conditions, which are found in many parts on the continent in general and southern Africa in particular. Reference has also been made to a 'post-Green Revolution era' to signal the need for moving beyond the Green Revolution mantra.

Despite these qualifications, research and extension efforts in agricultural innovations meant for smallholder farmers, who are in the majority in Africa and who are also food insecure, are based on the notion that Green Revolution is still the apotheosis of agricultural technology. As the highest form of agricultural technology, it is widely promoted, which explains the focus on propagating the innovations with little attention paid to dynamics of the knowledge processes by which the innovations are produced and disseminated (Akullo et al., 2018). Such efforts are informed by agricultural innovation 'fixes' which are based on idealised models of the way things should be, rather than the way they are, or likely to be.

The idealised models manifest themselves through ubiquitous and proliferating 'success stories', best practises', or 'low hanging fruits' that are regarded as universal, and transferable to other contexts (Danielsen et al., 2019; Juma, 2015; Molle, 2008), and have become the hallmark of narratives that have shaped and continue to shape the business of agricultural innovations.

But to what degree do these narratives contribute to sustainable rural livelihoods in Africa? The beginning point is to have a clear understanding of what narratives are. Narratives are stories that give a particular interpretation of physical or social phenomena that are enduring and influence the direction of interventions in society (Molle, 2008). They are promoted by particular actors on the basis of soft power and embody different framings, values and goals (Glover, 2019; Thompson, 2012; Scandizzo, 2010).

It is not difficult to see why these idealised narratives have gained a foothold in Africa. Reference is made to the fact that per capita farm output in South Asia and East Asia doubled and tripled respectively between 1966 and 2008, thanks to the Green Revolution, while in sub-Saharan Africa it fell by 25 percent during the same period (De Groote et al., 2005; Hunt). In sub-Saharan Africa grain yields in rainfed agriculture have remained stagnant at between 0.5 and 2 tons per hectare against a potential of ten times that number (Armanda et al., 2019; Gowing and Palmer, 2007).

Introduction of irrigation has not necessarily improved crop yields at least to the expected level (Danielsen et al., 2019; Nyamadzawo et al., 2013). The struggling agricultural sector in Africa is having several human consequences. More than 30 percent of the African population has been reported to be malnourished (CAADP, 2013). Africa failed to meet Millennium Development Goal

(MDG) 1 that sought to reduce by half the number of people who faced hunger and poverty by 2015. Africa is home to 19% of the world hungry, the highest amongst all regions and this number is projected to increase to 26% should the continent remain in the same trajectory (FAO, 2020). More than 60 percent of the population in Africa live on less than US\$2 per day, while 40 percent live on less than US\$1 per day. High poverty levels hinder farmers from making meaningful investment in agriculture thereby jeopardising sustainable agriculture-based livelihoods in particular and rural livelihoods in general.

The fact that Africa still suffers from food insecurity more than five decades after the introduction of the Green Revolution (Wise, 2020) seems to have done little to dampen the enthusiasm for Green Revolution. There is still a belief that millions of Africans can be lifted out of hunger and poverty if only a proper Green Revolution is to be designed and implemented. Anecdotal evidence is given as large-scale success and is used to drive the Green Revolution bandwagon.

However, even in cases where success stories of the Green Revolution are cited, the success can at best be described as patchy (Wise, 2020; De Groote et al., 2005). In East Africa (Kenya in particular), despite the government's best efforts at improving maize yields and increasing its marketing since the mid-1980s, the outcome has been disappointing (Armanda et al., 2019; De Groote et al., 2005).

Southern Africa does not have a better story either. Experiences from Zimbabwe depict a similar situation. In 1946, Zimbabwe was the first country in Africa, and the second country in the world after the United States of America to produce hybrid maize varieties (Alumira and Rusike, 2005). However, adoption of hybrid maize varieties was found to be less important as compared to addressing basic agronomic conditions (Alumira and Rusike, 2005) contrary to the claims made about the impact of miracle seeds (Wise, 2020). Rukuni (2006) concluded that the benefits of the maize green revolution in Zimbabwe were only realized by a privileged white large-scale commercial farming sector, and a minority of black smallholder farming sector located in high rainfall areas.

Success stories in maize production in Malawi and Zambia were found to depend heavily on donor subsidies (Wise, 2020; Dawson et al., 2016; Denning et al., 2009). Low adoption rates of Green Revolution technologies and limited or no impact on crop productivity and rural income and poverty, were also documented in semi-arid tropics in West Africa (Wise, 2020).

Against the weight of this evidence, the continued promotion of the Green Revolution agenda in Africa can only be attributed to the strength of its narratives. How else can one explain the fact that the Green Revolution is the *lingua franca* of many interventions in African agriculture (Atela et al., 2018) and Green Revolution policies continue to be promoted as the drivers of agricultural growth and poverty reduction (Dawson et al., 2016).

This paper seeks to promote an alternative narrative that can promote agricultural development, promote resilience and achieve sustainable rural livelihoods in Africa. The point of departure of the paper is that the positivist science and communicative rationality slant of the Green Revolution narrative overlooks peculiarities of the biophysical and socio-economic aspects of agricultural production, particularly in smallholder farming systems, which are dominant on the continent.

Simply defined positivist science is the belief that science always leads to development while communicative rationality is the belief that good communication leads to positive outcomes. The

limitations of the approaches lead us to propose a social constructivist approach to agricultural innovations (explained more fully in section 5) that is based on a proper contextualisation of the prevailing biophysical and socio-economic conditions, an understanding of the dynamics of agricultural innovations, as well as the nature of rural livelihoods in Africa. The southern African region is used as a case study. Section 2 of the paper provides a justification for focusing on southern Africa.

2. Why agricultural innovations narratives matter in southern Africa

There is no shortage of policy intentions to improve agricultural development in southern Africa. The Southern African Development Community (SADC)¹ Regional Agricultural Policy identifies agricultural development as crucial to the region. The policy seeks to promote regional and national collaboration as a way of encouraging competitive agricultural production and trade among member states. This echoes continental level efforts where the African Union (AU) New Partnership for Africa Development (NEPAD) vision prioritises food security and agriculture (AUC, 2015). This vision eventually gave birth to the Comprehensive Africa's Agricultural Development Programme (CAADP) (SADC, 2012). CAADP compels countries to invest 10 percent of national budgets into agriculture so as to achieve 6 percent economic growth. The 2016 CAADP guide, encourages countries to ensure that their National Agriculture Investment Plans are aligned with the long and medium-term development agendas and other national policies. Within this framework multi-stakeholder involvement in planning, implementation, monitoring and evaluation is identified as a key component.

Apart from the policy pronouncements, southern Africa is a good candidate for studying the dynamics of agricultural innovations because of a number of complementary and sometimes parallel efforts. Some examples are given.

The Consultative Group on International Agricultural Research (CGIAR) centers spearheaded research efforts aimed at addressing agricultural production, poverty and food insecurity under the auspices of the Challenge Programme on Water and Food (CPWF). CPWF was a 10-year long donor-funded initiative that was aimed at increasing food security and reducing poverty through better management of water for sustainable agriculture, in the Limpopo river basin² (Merrey and Gebreelassie, 2011).

Both the first and second phase of the CPWF were designed with the philosophy of promoting what was called research for development, emphasizing the need for the production of outcomes and impacts benefits to the society. The Centre for Coordination of Agricultural Resources and Development for Southern Africa (CCARDESA) is another initiative within Southern African whose mandate is to harmonise the implementation of agricultural research and development in the region (CCARDESA, 2018). There are also smaller efforts led and implemented by international and local research and development agencies, which are also donor-funded. In some countries, lack of government funding has meant that research and extension efforts relating to agricultural innovations are continually and exclusively donor-funded. The infusion of donor funding in agricultural research and extension has and continues to raise questions about agenda setting in African agriculture (Mutsvangwa-Sammie et al., 2017) and effectiveness of donor aid in Africa in general (Park, 2019). It is therefore important to compare the research and extension efforts in

agricultural innovations to the issues that have to be addressed within the areas and communities of interest.

Southern Africa's climate consists of arid and semi-arid climatic zones which account for 54 percent of its land area, this clearly illustrates that the region is moisture constrained as far as agricultural production is concerned (Spear et al., 2015; Ibrahim and Olaloka, 2000). Some studies claim that as much as 80 percent of the total land area in southern Africa is moisture constrained (Ngaira, 2009) with poor rainfall distribution being a far greater threat compared to the total amount of rainfall received.

Irrigation, which could mitigate against semi-arid conditions, is poorly developed. In southern Africa (as also applies to the rest of Africa), only 4 percent of the irrigation potential³ has been developed compared to Asia and Latin America, which have developed 38% and 12% respectively (FAO, 2011). There is also a general decline in irrigation development, which is attributed to the disappointing performance of past investments in terms of returns on investment (Bonilla et al., 2020). High cost of irrigation systems which are estimated at USD10, 000 per hectare, raise issues of sustainability (van der Zaag, 2010).

Sustainability challenges also emanate from the fact that irrigation schemes are often associated with high maintenance costs and routinely go through expensive rehabilitation cycles, which also are characterised by low crop productivity. Many smallholder irrigation operations cannot function without state or donor financial support (Dawson et al., 2016; Nyamadzawo et al., 2013). Meanwhile less than one percent of smallholder farmers, who constitute a large proportion of the farming population, have access to irrigation. Farmer-led irrigation development which is known to be financially sustainable does not often receive policy and financial support (Mutiro and Lautze, 2015).

Southern Africa is also characterised by poor structured and infertile soils (Whitfield et al., 2015; Mupangwa et al., 2011). Attempts at building up and maintaining soil fertility have been hindered by high costs associated with the use of inorganic fertilisers estimated to be six times higher in Africa compared to Europe (Bonilla et al., 2020; Morris et al., 2007). Poor soil fertility is compounded by low levels of fertiliser use. Less than 10 percent of smallholder farmers in Africa use fertilisers (Bonilla et al., 2020; Misiko et al., 2011; FAO, 2004) while the application rate is ten times lower compared to East and South Asia (Van der Zaag, 2010). Many smallholder farmers cannot afford to buy the recommended fertilisers as well as other inputs as seed, and pesticides (Zavale et al., 2020).

Marketing of agricultural produce and products is a big challenge. Many farmers have no access to markets, live far away from markets and face uncertain prices. The situation is not helped by poor inter-regional trade in agricultural produce and products (Myeni et al., 2019). Many smallholder farmers are merely subsistence-oriented resulting in low land use and productivity.

The multi dimensions of agriculture in southern Africa and the complex array of issues, are a clear reminder and indicator that development of agricultural innovations in Africa is not a simple undertaking. In the rest of the paper, we further explore these issues further.

3. Agricultural innovations: scope and approaches

In general attempts at addressing the precarious food and agricultural situation in southern Africa have been mainly premised on ‘delivering’ agricultural innovations to farmers. Spearheaded by the state and donors, this techno-centric view pushes the argument that farmers need to adopt improved agricultural innovations, and that many do not do so because of a lack of knowledge (Schnurr and Mujabi-Mujuzi, 2014).

There is, however, an opposing view that sees farmers as rational beings whose decision-making process is based on an understanding of their needs, and careful weighing up of investment options and risks (Wise 2020; Fafchamps, 2009). According to this view, farmers take a holistic approach focusing on livelihood needs rather than mere adoption of innovations (Matthews, 2017; Sturdy 2008). Farmers have been known to accept innovations technologies for other strategic reasons, which have little to do with the innovation itself (Mutsvangwa et al. 2018).

These findings go against the ethos of the innovation diffusion theory, which has been highly influential in explaining the technological adoption process in agriculture. The theory offers an oversimplified model of what happens during the adoption process by taking a snapshot of the practise without considering the dynamics, processes of learning and experimentation, which are essential in the innovation process (Glover et al., 2019; Matthews, 2017; Temple et al., 2016; Mica, 2013).

In order to lay the groundwork for exploring the role of agricultural innovations as a means to secure agriculture-based livelihoods, we provide a sketch of the dominant approaches of agricultural innovations in the last 40 years and the uniqueness of agricultural innovations. The choice to describe approaches instead of theories was based on the fact that, the narratives have been shaped by approaches rather than specific theories. After we provide the sketch, a description of the elements for developing a framework for exploring the role of agricultural innovations in securing agriculture-based livelihoods and rural livelihoods in general is given.

3.1. Approaches to agricultural innovations

Before the 1990s, approaches to agricultural development in Africa, employed by development agents (researchers, extensionists and development practitioners) were based on a linear approach (Temple et al., 2018; World Bank, 2006). The belief was that ‘proven’ knowledge and technologies generated by research would be transmitted to extension staff, who would then pass these on to farmers. This “linearity” approach failed partly because of the complexities and dynamism associated with agricultural systems (Glover, 2019; Leach et al., 2010).

In the past 40 years, a number of approaches relating to agricultural innovations have been developed as a response to the limited success of conventional research and development in transforming African agriculture (Whitfield, 2015; Malton, 2009). As can be seen from Fig. 1, three major approaches have influenced agricultural research and development since the 1980s: 1) national agricultural research system (NARS), 2) agricultural knowledge and information system (AKIS) and 3) the ‘innovation system’ (IS) (Hall, 2009). Since it is still contemporary, the innovation systems approach deserves a bit more discussion. It is, however, worth mentioning that there are

variations with the innovations stable. For the purposes of this paper, there is no attempt to go into detail about these variations.

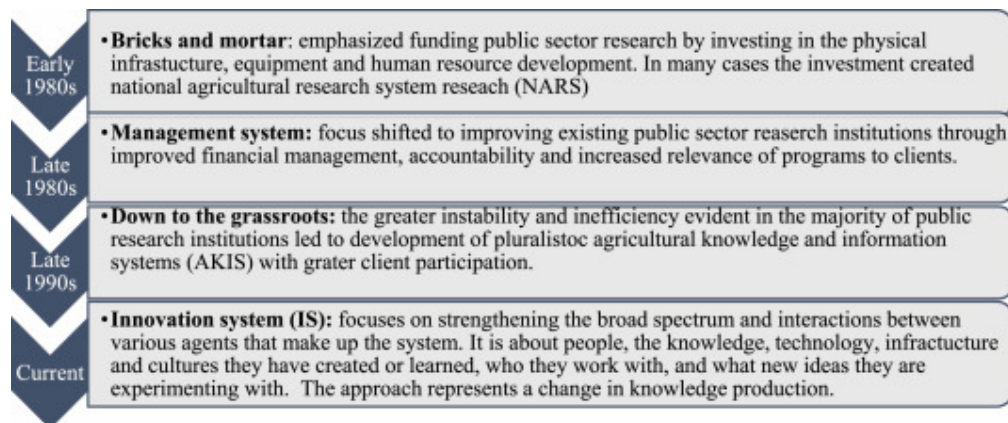


Fig. 1. Changing approaches to investing in agricultural innovation capacity (Adapted: World Bank, 2006).

The innovation systems approach was birthed from the realisation that development was more about change and not just about knowledge and technology, hence the need to widen the focus of the debate (Glover, 2019; Hall, 2009; World Bank 2006). That is why more attention was given to the development of wider competencies, linkages, enabling attitudes and practices, and governance structures and policies that allow this knowledge to be put into productive use (Temple et al., 2018; Matthews, 2017; World Bank 2006). Farmer participation was regarded as key in the development of the innovations.

The innovation systems approach bears some resemblance to earlier approaches (Friederichsen et al., 2013; Zhou, 2008), and therefore exhibit similar weaknesses. Three, are worth highlighting here. Firstly, rural livelihoods are equated to agricultural development. While agricultural development contributes to rural livelihoods, there is enough evidence to show that rural livelihoods are more complex (see below). Secondly, the approaches have not found a way of dealing with soft power in the promotion of agricultural innovations (Mutsvangwa-Sammie et al., 2018). Thirdly, while recognizing the complexities that relate to agricultural innovations, in practice, innovation systems are taken as a blueprint instead of providing a set of principles and best practises (Mockshell and Birner, 2020). But to what extent are the approaches cognisant of the uniqueness of agricultural innovations?

3.2. The uniqueness of agricultural innovations

Agricultural innovations are mainly concerned with the need to increase production and enhance the quality of products to mitigate challenges associated with agricultural production (Whitfield et al., 2015; van der Veen, 2010). This is undertaken within a complex and dynamic interaction of multiple actors, actions and activities involving growing, processing, packaging, distribution, consumption or disposal of agricultural produce and products (Dawson, 2016; Rajalahti 2011). As a consequence, agricultural innovations should not be considered to be the same as other innovations although there may be some similarities (Daane et al. 2009). Three dimensions are worth highlighting. Firstly, agricultural innovations at the production stage depend on the weather, which cannot easily be controlled, unless under controlled environments (such as greenhouses), which is however

expensive and cannot be afforded by many African farmers. Agricultural innovations are therefore deployed under conditions that vary in space and time, which makes it difficult to be definitive about many of the aspects.

For example, rainfall patterns vary over very short distances and are also characterised by inter and intra-seasonal variations. Secondly, weather factors interact with other equally heterogeneous biophysical elements, such as soils, which also vary over short distances (Mockshell and Birner, 2020; van der Zag, 2010).

Thirdly, agricultural production has strong socio-cultural dimensions, which however, tend to be overlooked or are not adequately dealt with. Crafting agricultural innovations that take into account different clientele such as gender and age is not easy. This should however, be considered because in Africa, women smallholder farmers are the majority, as well as the fact that Africa has a very youthful population.

3.3. Effectiveness of agricultural innovations

Agricultural innovations narratives are also shaped by the effectiveness of agricultural innovations in relation to how they contribute to a change at the farm and society level. The measurement imperative has tended to produce claims and ascriptions that cannot be corroborated (Mockshell and Birner, 2020). The quest for objectivity captured by figures, can turn out to be subjective if figures are not used carefully. Below is a brief description of the categories that are used to describe the effectiveness of agricultural innovations.

‘Outputs’ are defined as the first and immediate results of a project. They are often easy to measure, and tend to be more specific and detailed, because they are often under the control of the researcher. The other categories are less clear to many researchers, and are therefore poorly conceptualised and presented. These include, ‘outcomes’ that are defined as, external use, adoption or influence of project's outputs by next and final users, that results in adopter-level changes needed to achieve the next intended impact. ‘Impact’ is the ‘big picture’ i.e., in economic, environment and social conditions that a project is working towards (Walker et al., 2008).

Changes brought by agricultural innovations are also described using relationships such as efficiency (input-output relationships) or the various stages associated with promoting the innovation (inputs-outputs-outcomes-impacts) (Pant, 2010). Simple input-output analysis (e.g., that are used to measure economic impact such as cost-benefit analysis and internal rate of return and outputs) are also used. The relationships get more complex and practically less useful as they grow in complexity.

The impact pathway, which is favoured by many funders is a case in point, Walker (2008) notes that during implementation of a project, there is a decline in influence of a given innovation on subsequent stages and the increasing complexity and difficulty of attributing an impact to a specific innovation. This is because agricultural innovations systems are complex, and dynamic (Whitfield et al., 2015; Pant 2010; Daane et al. 2009), and attempts of presenting results as simple inputs-process-outputs-outcomes-impact model, might prove not really useful.

4. Critical elements for an agricultural innovation framework that contributes to sustainable livelihoods

It is important to identify and describe what are the critical elements of a framework for crafting agricultural innovations, which constitute the building blocks in the construction of a theory of change that will lead to the realisation of sustainable rural livelihoods (Fig. 2). These are briefly described below.



Fig. 2. Critical issues in crafting agricultural innovations.

4.1. Context

Some analysts believe that one reason why ‘innovations’ have failed to secure agriculture-based livelihoods is the ‘one size fits all’ approach where it is thought that technologies can succeed in all situations (Wise et al., 2020; Tenywa et al., 2011). Different farmers however, face and operate in contexts that are characterised by a wide variety of socio-economic and bio-physical conditions (Matthews, 2017; Sturdy et al., 2007). Exposure to episodic severe external shock to livelihoods due to these conditions is the rule rather than the exception. This is not always realized, and if realized, is not adequately addressed.

A good example of the one size fits all approach is conservation agriculture (CA), which has been widely promoted by both government and donors in southern Africa (Mutsvangwa-Sammie, 2020; Mazvimavi and Tomlow, 2009). Despite the huge investments in the promotion of CA, cases of success have been mainly limited to favourable areas with suitable soils and favourable inter-seasonal rainfall distribution (Thiefelder et al., 2012; Giller, 2011).

Agricultural innovations are explicitly and implicitly premised on improving agriculture-based livelihoods. In many cases, however, there is a lack of recognition that rural livelihoods are complex (Glenna et al., 2011; Wu and Zhang, 2013) especially for households living in areas that are

marginally suitable for agricultural production. Such households adopt risk-averse strategies to counteract recurrence of drought and other uncertainties (Cousins and Scoones, 2010). It is not clear, to what extent agricultural innovations are developed with the understanding that rural livelihoods are complex, dynamic and combine both formal and informal economic activities (Matthews, 2017).

One of the monumental failures about agricultural innovations has been the tendency to want to change the way things are done within communities and regions, by introducing new technologies, often within very short time horizons, while using inappropriate tools. Instead of efforts directed at understanding the diverse strategies that are adopted by rural communities in response to their own situation and environment, the reverse has been true (Glenna et al., 2011). Many of the agricultural innovation attempts have been based on standardisation rather than diversification, and yet the latter is characteristic of African rural areas. Rural livelihood diversification is the process by which rural livelihoods construct a diverse portfolio of activities and assets so as to survive and improve their standard of living (Carney, 2002).

4.2. Goal of agricultural innovations - securing C diverse livelihoods

Any agricultural innovation that hopes to succeed must be based on the appreciation of the diversified livelihood strategies that rural people engage in (Glenna et al., 2011). For many rural people, diversification of livelihoods is an essential response strategy for coping with short and long-term changes in the environment and the economy, and demonstrates a household's ability to mobilise its asset base in a flexible manner and in response to changing circumstances.⁴

The benefits of diversity are however, context specific. Not everyone accepts that this concept of diversified livelihoods is useful. It has been argued that diversified livelihood strategies may not be a reflection of various opportunities available to rural families, but are rather an outgrowth of the lack of opportunity to specialise in higher earning income activities. While this may be true in some cases, this does not diminish the importance of diversified livelihoods. Recognizing the existence of diversified livelihoods is likely to aid the realisation of sustainable livelihoods as opposed to a proposition that pretends that all rural livelihoods are exclusively agriculture-based. Acknowledging diversified livelihoods aides to show the importance of understanding how various components within rural economic and social systems work and fit together as well as shining light on the operationalisation of the sustainable livelihoods framework.

Sustainable livelihood framework is defined as a systematic and adaptive approach that recognizes how households cope with and recover from stress and shocks, maintain or enhance capabilities and assets, so as to secure sustainable livelihood opportunities in the short to long term (Moorse et al., 2009).

The attractiveness of the sustainable livelihoods concept lies in its applicability in different contexts and in situations of uncertainty. It is also based on a consultative and participatory process that allows cross-fertilisation and translation of ideas and strategies between various stakeholders. It has however, been noted that the interpretation of the concept sometimes leads to divergence rather than convergence in terms of its application. If the sustainable livelihood concept is to be useful, there is need for location-specific evaluation tools and a clear working definition to ensure its

operationalisation (Farrington, 2003). This is important for the realisation of the desirable social outcomes.

4.3. Underlying power dynamics in agricultural innovations

Agricultural research is characterised by power asymmetries, between and among farmers, as well as between farmers and proponents of research (Mockshell and Birner, 2020; Whitfield et al., 2015). Sound technical interventions may fail to achieve intended goals because of adverse power structures (Mockshell and Birner, 2020; Shiffer, 2007). Power dynamics are skewed towards vested interests of the corporate world and scientific community (Hall et al., 2010) with the result that the voice of the 'beneficiaries', especially of poor communities, is often not heard in the development of agricultural innovations.

To redress this challenge, empowerment has been put high on many institutions' agendas (Mockshell and Birner, 2020). Some projects use the bottom-up approach as a way to 'empower' farmers. Contradictions however have been reported. There are cases where facilitators in the form of public agencies or donors, tend to downplay and ignore power dynamics or even construct new power dynamics (Kezar, 2011). Donors are known to fund projects that narrow to their interests. In the quest for success, sometimes donors shun poor households and target resource endowed households, which can guarantee high adoption rates (Shiffer, 2007; Mutsvangwa et al., 2018). By so doing altruistic development goalposts are changed in favour of project success.

But it is not only donors who indulge in agenda setting. Private companies can lobby government to roll-out certain agricultural technologies that do not necessarily benefit local communities. In addition to such political economy-rent seeking, the private sector, can use its economic muscle in the marketplace to promote its interests. Addressing power dynamics in innovation studies is difficult because they are regarded as external to agricultural innovations (Hall et al., 2010).

Despite the difficulties of accounting power in the development of agricultural innovations, bold steps must be taken. As already noted, agricultural research and innovation, however technical, cannot escape issues surrounding power or governance in more general terms. Engaging in this difficult task may lead to the achieving openness and transparency, stakeholder participation, and ethics that are often cited in research endeavours (Whitfield et al., 2015).

To conclude, we make the observation that power is not routinely considered in the design and implementation of agricultural innovations. This is because innovations are often portrayed as being power neutral, which has resulted in the marginalisation of women, youth, and subjugation of indigenous knowledge (Friederichsen et al., 2013).

4.4. Scalability of innovations

Donors, policymakers and scientists desire that projects bring about lasting impact on the 'beneficiaries' and that viable innovations achieve their full potential impact, through high adoption levels (Van Loon et al., 2020; Merrey and Gebreselassie, 2011). This is why there has been much interest in documenting and seeking to explain how innovations can be scaled out and scaled up. Scaling out looks at the geographical spread of innovations through replication and adaptation, while scaling up refers to the adoption of innovations at higher organizational levels (Menter et al., 2004).

Rather than focus on measurements to assess scaling up or scaling out, we argue that the conditions for scalability should receive first priority. This is because the relationships between the factors that make the agricultural innovation ‘system’ do not hold as the innovation is scaled out or scaled up. Besides, the implementing institutions such as public entities, are often called upon to assume more responsibilities for scaling out or scaling up without the requisite resources. The lack of spontaneous scaling out or scaling up of innovations is an indictment on the innovations themselves and their promoters. This explains continued external support resulting in donor syndrome (Van Loon, 2020; Cohen et al., 2008).

One important step for improving the scalability of innovations is to understand the elements that are commonly deployed to contribute to effective scaling out/up (Table 1). There are, however, a number of problems with this representation of potential scalability. Firstly, most projects/programmes have too short a project lifespan to accommodate all the steps and stages. Secondly, not enough resources are allocated for the processes that should be undertaken. Thirdly, the focus on measurability may end up being a distraction from the critical process issues. Fourthly, the conventional research issues may play second fiddle to power dynamics. Lastly, such instrumentalist perspectives as outlined in Table 1, are seldom achieved in the real world.

Table 1. Elements to effective scaling up or out (Source: Menter et al., 2004).

PROJECT PHASE	ACTIVITY RELEVANT TO SCALING UPS	STRATEGIC ELEMENTS TOWARDS SUCCESSFUL SCALING UP/OUT
PRE-PROJECT	Situation analysis	Engaging in policy dialogue on pro-poor development agencies Identifying community, institutional and environmental enabling and constraining factors
	Identifying target groups	Identifying appropriate research objectives and outputs within developmental processes to ensure widespread uptake
	Developing M&E system	Identifying indicators and planning, monitoring and evaluation methods and processes
	Collaboration	Building networks and partnerships to increase ownership and pathways
	Funding mechanisms	Developing appropriate funding mechanisms to sustain capacity for expansion and replication.
IMPLEMENTATION	Capacity building	Building capacity and institutional systems to sustain and replicate
	Partnerships	Demand, supply and support actors identified
	Networking	Other resource organisations contribute with products and by building technical capacity
	Raising awareness	Multi-media dissemination of findings
	Policy dialogue	Aggregate and assess findings from individual projects and derive policy-relevant information
	M&E and support studies	Central scaling up processes in providing evidence to influence policy makers, in deciding what should be scaled up, and how this might be achieved
POST-PROJECT	Exit strategy dissemination	Concerted action should involve target groups as disseminators
	Impact assessment	Built upon monitoring and evaluation. Representatives of target group should be part of the assessment team

5. Towards a social constructivist approach to conceptualising agricultural innovations

To ensure that agricultural innovations contribute more directly to sustainable rural livelihoods, there is need to draw upon a broader knowledge base than hitherto commonly relied upon. Given

the complexity of the issues as demonstrated in this paper, we argue that the social constructivist view on agricultural innovations and rural livelihoods is an important option. It focuses on how knowledge emerges in society, recognizing the importance of knowledge holders and interpreters, taking note of the different social discourses at different times, which lead to a better understanding of how innovations are conceptualised, constructed and implemented (Glover et al., 2019; Matthews; 2017; Weber and Khademian, 2008).

It is critical to understand that societies, communities, groups and professionals develop forms of narratives that frame and give meaning to the knowledge and information involving agricultural innovations. But we have already seen in this paper, not all narratives find space in the public domain, hence reference to dominant narratives. The discussion of narratives surrounding agricultural innovations are just as important as the agricultural innovations themselves.

Another important discussion point relates to the dynamics of knowledge, not just in relation to agricultural innovations, but in general. Knowledge must be understood in particular geographical, political, economic, social, and cultural settings (Weber and Khademian, 2008). It is also important to differentiate between knowledge and information. Information is data that has been given some meaning by way of relational connection, while knowledge is a combination of information, context and experience (Chen, 2005) or socially mediated information (Matthews, 2017; Weber and Khademian, 2008). How to turn available information into knowledge that is practically useful, is crucial. In the context of our discussion, it is important to relate information and knowledge to agricultural innovations, agriculture-based livelihoods and sustainable rural livelihoods.

Majule et al. (2008) present a useful overview of the issues that need to be considered when thinking about agricultural innovations, by combining the sustainable livelihoods framework, the innovation system and learning alliances approach. To some extent this mirrors the complexity of rural development. The learning alliance is founded on the idea that the key challenge is not in devising new technologies but in bringing about appropriate institutional change within a relevant innovation system. But, as we have already alluded to above, this should not reduce the problem to one of lack of information and communication. This underlines the importance of not overlooking the theoretical aspects of knowledge production.

The unpacking the narrative of agricultural innovations needs to incorporate insights from rural sociologists and broaden the understanding of 'science'. (Kloppenburger, 2008). Science in the context of agricultural innovations, needs to be understood as a socially constructed subject to social influences (Kloppenburger, 2008). A social constructivist approach to science or knowledge is better suited to give a narrative of agricultural innovations, this represents an improvement to the positivist science and communicative rationality approach, which hitherto has shaped the dominant agricultural innovations narrative.

We briefly examine the merits of the notion of communicative rationality as presented by Habermas. According to Habermas discussion around information and knowledge should be based on, deliberative communicative action that assumes that participants are not only knowledgeable but act rationally to achieve a common good (Habermas, 1984; Cammaerts, 2011). Critics of the Habermas, question the assumption that a multi-stakeholder dialogue and debate can build consensus based entirely on reason and rational communication (Mehta et al., 2007). Although not widely acknowledged framing agricultural innovations on the Habermasian communicative

rationality is counter-productive, not least because it underplays the dynamics of power which have been demonstrated to be part and parcel of agricultural innovations.

A proper acknowledgment of power needs to be mapped and located within social relations that obtain in society (Glover et al., 2019; Stirling and Mayer, 2001; Giddens 1990). In this regard the role of agency and structure in social change, needs to be understood (Edwards et al., 2005). Giddens' structuration theory (1984) argues that actors or agents and the structures in which they are embedded in have a dual relationship. In other words, patterns of social practises reflect a virtual order of rules, resources and transformative relations that have potential to constrain or enable planned activities (Matthews, 2017; Klerkx, 2009; Aarts et al. 2007). Planned activities are therefore constrained or facilitated by structures, which can be understood as the social constraints- and human agency.

Social constraints and human agency speak to how people are able to act or influence what is happening, this means that as a result the structures are not of themselves deterministic. However human agency by itself cannot and does not lead to desired social outcomes. For example, no matter how women farmers can desire and work towards social change, this cannot happen without addressing the inhibiting social structures in society.

6. Conclusion

This paper sought to unpack the narratives of agricultural innovations as the *sine qua non* for sustainable rural livelihoods in southern Africa. It showed that the positivist science and communicative rationality slant of the dominant narrative around innovations overlooks peculiarities of the biophysical, socio-economic and cultural aspects, together with the political economy of agricultural production. More critically, the narrative does not adequately engage with the landscape of diversified rural livelihoods, which is characteristic of the majority of people in southern Africa. This characteristic was identified as being unhelpful to the cause of agriculture-based livelihoods, which are what agricultural innovations specifically seek to achieve together with the more general objective of creating sustainable rural livelihoods. A social constructivist approach was proposed to take account of the nature of knowledge production. In simple terms, knowledge is made by people with particular goals and objectives, with explicit or implicit power implications, and is not produced in a politically, economically and socially neutral environment. Thinking through these issues might potentially improve the role of agricultural innovations towards contributing to sustainable rural livelihoods in southern Africa.

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