A Review of Innovation Systems Framework as a Tool for Gendering Agricultural Innovations: Exploring Gender Learning and System Empowerment

ANN N. KINGIRI
African Centre for Technology Studies (ACTS), Nairobi, Kenya

ABSTRACT Purpose: To reflect on the opportunities that a systems understanding of innovation provides for addressing gender issues relevant to women, and to provide some insight on how these might be tackled.

Approach: Review of literature relating to gender issues and how they relate to achieving, on the one hand, equity and efficiency goals, and on the other hand innovation in agriculture. The analysis draws lessons that inform an analytical framework for gendering agricultural innovation in an African context.

Findings: The analytical frameworks that have been used to debate gender have ignored the complex environment under which gender roles manifest. The review analyses the innovation systems framework as a tool for gendering agricultural innovations, including embedded activities like agricultural extension services. This framework has provision for actors and their roles in the agricultural innovation system and embedded sub activities.

Practical implication: The article concludes with a call for a shift from gender analysis to gender learning and a shift from women's empowerment to empowering innovation systems capacity.

Originality/Value: In the current context under which agricultural systems are becoming increasingly integrated, an analytical approach that takes cognisance of the complex environment under which gender and gender roles manifest is of interest for policy-makers, gender advocates and development workers for identifying entry points for engendering innovations towards gender equity in Africa.

KEY WORDS: Gender, Agricultural innovation system, Innovation capacity, Gender learning, System empowerment, Africa

Correspondence address: Ann N. Kingiri, African Centre for Technology Studies (ACTS), Gigiri Court, Off United Nations Crescent, P.O. Box 45917–00 100 Nairobi, Kenya. Email: ankingiri@gmail.com or annakingiri@yahoo.com
1. Introduction

This article attempts to review gender and innovation discourses with the aims of stimulating debate within different segments of the agricultural innovation value chain, including extension services, on the way gender is being addressed and on the possible need for mid-course corrections. The article is conceptually based in an attempt to bring into the limelight the constraints that may impact the effective delivery of services towards an improved innovation process that takes cognisance of the needs of rural communities, including women engaged in agricultural innovation. This article asks how men and women, as well as socially excluded groups of agricultural innovators, are represented and their interests safeguarded in innovation. This is important as an effort to gender innovation towards harnessing existing opportunities and identifying gaps for learning and building requisite innovation capacities for pro-poor innovation (Berdegue 2005). The article is based on the understanding that women and men have different potentials and capabilities to influence economic change (World Bank 2005, 2007b). The discussion advanced in this article takes cognisance of the diversity of the context in which innovation takes place, including the political and policy environment (World Bank 2006). It also recognises the complexity of the task of trying to analyse the gender-innovation interface, considering the underlying debates that relate to each (Blake and Hanson 2005). Some of the questions this article endeavours to address include the following:

- With regard to marginalised groups (for example, poor farmers and women), are they being given equal opportunities to contribute productively to the innovation process, considering the cultural, social and political diversities? What are the factors that may be impeding or facilitating them and are they being addressed or harnessed?
- What are the principles for a gendered innovation systems approach to research, extension and use of agricultural innovation?
- What are the opportunities for policy to enhance improved contribution to the innovation process by different groups of farming communities, including women?

The article conceptually opens up the debate around how we ought to be thinking about gender from a more holistic perspective that takes cognisance of the political and knowledge economy of innovation. The purpose of the article is to reflect on the opportunities that a systems understanding of innovation provides for addressing gender issues.

The discussion proceeds in several parts. In section 2, I begin with a brief introduction of gender and gender concepts based on the way they have been conceptualised more generally. This ushers in a review of trends on the gender dimension of development as debated in gender and development literature in section 3. Section 4 provides a background on the emerging debates around innovation in agriculture and its multidimensional nature in terms of knowledge production and the embedded social and institutional processes. Section 5 attempts to understand the sort of analytical framework that would accommodate the diverse components and
elements of gender and innovation. The article concludes with a call for major shifts in practice and analysis of gender issues in agricultural innovation.

2. Gender and Gender Roles as Analytical Concepts

Gender and gender roles have been defined extensively as informed by different contexts. The descriptions provided in this section have been adopted from FAO (1997, 2004). Gender refers not to women or men, per se, but to the relations between them. Gender is not defined biologically as a result of sexual characteristics of either women or men, but is socially constructed. It primarily refers to socially determined ideas, practices and attributes of men and women, including female or male roles. In other words, gender is about what men and women do; their degree of access, control and authority to resources and decision-making; and their abilities to discharge these duties effectively. It is a central organising principle of societies and often governs the process of production, reproduction, consumption and distribution. On the other hand, gender roles are the ‘social definition’ of women and men and vary among different societies and cultures, classes and ages, and during different periods in history. Gender-specific roles and responsibilities are often conditioned by household structures, access to resources, specific impacts of the global economy and other locally relevant factors, such as ecological conditions. Gender relations and patterns show major differences in division of labour, access and control over production resources compared to the accruing benefits as well as decision-making on developmental matters and skills, particularly in science and technology areas (FAO 1997, 2004). Understanding these concepts is important in any research that seeks to promote gender perspectives in any development-related agenda.

3. Analysis of Trends and Debates in Gender and Agricultural Debates

There is a vast body of secondary and scholarly literature on various aspects of gender and agro-based technological innovation. Mainstream development agencies and certain journals have published reports, policy briefs and technical data and guidelines related to this subject. This literature as demonstrated in the subsequent sections shows that gender evaluation has evolved along different trajectories that resonate with women and development or gender and development debates. Drawing insights from this and other sources on gender and development, discussion in the subsequent sections is structured along several lines: The first part looks at gender in relation to women and development concepts. This sets the pace for an exploration of the dynamics of gender in agricultural development in the last section.

(a) Women in Development versus Gender and Development

Gender issues have been a global concern for a long time and this has radically changed the way development and poverty are conceptualised. Two main theses emerge from this: the Women in Development (WID) thesis on the one hand, and the Gender and Development (GAD) thesis on the other. The WID concept is supported by the argument that women, particularly within rural communities and those engaged in agriculture and natural resource management, play a significant role in rural development. It also takes into consideration the fact that women and children
form a significant portion of the rural poor. The early conceptualisation of the WID concept was limited to the context of human rights. Actual developmental agendas that dealt with concerns of women started in the 1970s. It was around this time that Boserup (1970) investigated, from an economic perspective, the role of women in economic and social transformation of poor countries, including those in Africa. She noted that as a result of modernisation and colonisation, new technologies introduced in these countries kept displacing the labour of women. This opened up a new strand of thinking that was shaped by the realisation that technologies are not gender-neutral, and are not always equally available to men and women. In 1975, the UN spearheaded the declaration of 1976–1985 as a decade for women. By the 1980s gender had been assimilated into the development agenda in various ways, with many development agencies and multilaterals, such as the World Bank, leading in efforts to include women in development (World Bank 1989).

The WID concept took on a different dimension after the Beijing Platform for Action was adopted at the UN World Conference on women in 1995. Several actionable areas were identified and, with respect to agriculture, these included an increase in women’s role in power-sharing and decision-making as well as the promotion of gender equality in the management of natural resources and safeguarding of the environment. What can be deduced from these debates reflects what has been described as the feminisation of agriculture and poverty—a development that has been criticised by feminist theorists. Jackson (1996), for instance, describes this as an ‘anti-poverty approach to women’, portraying women’s poverty as the major cause of underdevelopment. Jackson sees this strand of debate as having pushed gender into a poverty trap, where the poverty of women is seen as ‘justification for development interventions designed to improve the position of women’ by development agencies. She further describes how the same multilaterals have ‘feminised poverty’ by implying that all households headed by women are poor, which is erroneous as the ‘subordination of women is not caused by poverty’ (Jackson 1996, 501). She proposes that rescuing gender from the poverty trap requires poverty-independent gender analyses and policies.

The other perspective on gender—GAD—revolves around the realisation that development may not happen without the strategic promotion of equity between women and men, and that gender roles and relationships matter (IFAD 2000, 4). The inequalities are reflected in basic human rights, resources and economic opportunities, among other factors which collectively are inextricably linked to poverty (World Bank 2001). This seemingly holistic approach to gender and development has been concretised through gender mainstreaming. Indeed, gender mainstreaming has become part and parcel of the development agenda in many sectors and programmes, resulting in the integration of gender in various policies, including those that relate to knowledge production and use (IFAD 2000). Consequently, gender analysis tries to bring out the different ways male and female roles interact in research, extension, project goals and outcomes for the purpose of efficacy and effectiveness of development activities (Poats 1991, 6). It leads to a better understanding of human resource needs and capabilities and serves to address the gender inequalities existing among different players involved in development. Ultimately, this is expected to lead to a more equitable distribution of resources and benefits.
The two views of gender have not, however, helped much in terms of development efforts impacting real change in poverty levels. Despite many efforts to address women and gender issues in development, the implementation of proposed intervention strategies has remained a challenge and, perhaps, the reason why the United Nations has proposed the formation of a single agency to deal with gender issues (Green 2010).

(b) Gender, Agriculture and Development

Many reports have discussed extensively the relationship between gender, agriculture and development. Indeed the importance of gender in development has been recognised in recent efforts to address poverty. For instance, among the policy instruments that have triggered reconceptualisation of gender are the Millennium Development Goals (MDGs), which, although multi-sectoral and broad in nature, bring out the different dimensions of development (United Nations 2000). They recognise the need to enhance the different capabilities of the poor and marginalised in order to promote economic growth. The ultimate goal of addressing extreme poverty calls for consideration of gender dimensions of different developmental activities and initiatives, particularly in Africa where poverty is rampant. There is a growing realisation that addressing the poverty reduction challenge in order to achieve the MDGs must engage the poor communities who are, in most cases, the most disadvantaged in different respects. Consequently, many development and funding bodies take cognisance of the importance of gender dimensions in development and poverty reduction (IFAD 2003). Attainment of all the MDGs has gender dimensions and implications with regard to achieving sustainable development (World Bank 2007a; United Nations 2000). Some, however, speak directly about gender. Goal 1, which seeks to eradicate extreme poverty, has debatably pronounced gender dimensions. Looking at the skewed mechanisms for access to and control of production resources, then, poverty has a profound gender dimension. This is in view of the disparities that exist between poor and marginalised groups in terms of access to resources, power relations and inclusions in decision processes. Goal 3 seeks to promote gender equality and empower women for development. According to the World Bank (2007a) this is important for basic reasons, namely fairness, equality of opportunity and economic well-being. It is also vital to advancing the other millennium goals. In addition, improving gender equality also influences poverty reduction and growth directly through women’s greater labour force participation, productivity and earnings (World Bank 2008).

Despite the undisputed point made that both men and women are known to participate in agricultural systems in different ways, the debate has been skewed towards women. Arguably, the fact that women play an important role in agricultural development situates them as key economic drivers of development, particularly in developing economies. The Commission for Africa (2005) report notes that there is ample evidence to support the point that women make a greater contribution to economic life than men. They are perceived to be key agents through whom poverty and food security issues must be addressed, particularly in Africa through technological empowerment. Indeed, it has been argued that rural poverty is deeply rooted in the imbalance between what women have and what they do, but their potential to impact development is hampered by gender inequalities, which shape the
economic roles played by both men and women (World Bank, FAO, and IFAD 2009). It has been noted that gender inequalities constrain women more than men in competitiveness and entrepreneurship, particularly in Africa (Bardasi et al. 2007). Thus, women have occupied the most space in gender debates, including those around research, development and policy arenas. Consequently, gender mainstreaming efforts have focused on women and gender imbalances in terms of resources, right and voice geared towards gendering development and fighting poverty (World Bank 2001).

The ‘Gender in Agriculture Sourcebook’ (World Bank, FAO, and IFAD 2009) has revealed a number of gender issues that significantly complicate the bumpy process of agricultural development. These include:

- Gender differences in roles and activities that affect food security and household welfare; access to resources (land, water, incentives such as credit, knowledge and skills in science, technology and innovation, extension education).
- Participation and power in land, labour, finance and farm implements; participation by marginalised groups in markets, economic ventures and decision-making; participation and leadership in rural organisations.
- Socially constructed relationships between men and women.
- Varying and contextual cultural factors and beliefs resulting in negative sociocultural practices.
- Impact of biodiversity and commercialisation; risks and gains along the production value chain.
- Inadequate relevant policies, particularly those that interface gender and innovation and literacy levels.

The sourcebook also points out that gender-based inequalities along the food production chain brought about by these factors slow the attainment of food security—which is the main objective of sustainable agricultural growth as well as economic and social development. These gender differences manifest in different ways in different contexts. First, rural communities have significant impacts linked to the alignment of technological development along gender lines. These are, however, influenced by cultural factors with respect to decisions on ownership, allocation and disposal of resources and benefits accruing from them. The decisions on who purchases and uses particular modern technological innovations such as seeds, fertilisers and pesticides may already be predetermined, based on social and cultural dynamics of society (Kakooza et al. 2005). With regard to perception and adoption of modern technological innovations, there are certain gender dimensions based on different impacts on women and men as well as distinct cultural factors. It has been noted, for instance, that new technological innovations tend to benefit men more than women, lessening the workload of the former and increasing the activities linked to women, such as transplanting, weeding, harvesting and processing (Quisumbing and Pandolfelli 2008). It has also been argued that modern biotechnology will also benefit men more than women (Thomas 2003; Expert Report 2004).

Second, with regard to gender roles, gender-differentiated technology in sub-Saharan Africa denotes the way technologies are developed and tailored according to the stereotyped roles of women and men. Moreover, technology is highly gendered,
based on access to resources and benefits, with men and women playing different roles in technological development (Kakooza et al. 2005; Buvinic and Mehra 1990; Nompumelelo, Gumede, and Oketch 2009). It has been reported that although both men and women jointly play key economic roles in the agriculture sector, women are more active and have embraced farming with poverty reduction objectives (World Bank 2005, 2007b). Farming in sub-Saharan Africa is mainly small-scale and subsistence in nature, resulting in women playing a more substantial role than men as farmers and producers (FAO 2007). Rural women are the main producers of the world’s staple crops, providing 90% of food consumed by the rural poor, playing significant roles in sowing, weeding, tendering, harvesting and threshing (World Bank, FAO, and IFAD 2009, 522). In DFID (2007) it is argued that improving access to requisite resources (for example, seeds) for rural women to the same extent as men would increase agricultural production by 20%. These reports generally present women as the more aggressive gender in agricultural development and this may have enhanced the adoption of the feminisation of poverty approach discussed previously.

Despite the above-mentioned highlighted gender issues that impact agricultural development, men and women differ in their access to, and control over, inputs, productive resources and services, which limits the opportunities for men and women to participate productively in agricultural development (Bardasi et al. 2007). According to Kameri-Mbote (2009, 91–92), this is attributed to different factors. First, the power relationships between males and females are socially constructed and this dictates entitlement to resources. Second, legal orders used to allocate resources are gender neutral and tend to favour men. For instance, women, especially in developing countries, have few independent rights to land and natural resources. This presents some barriers to developmental opportunities like acquisition of credit using land as collateral. Third, the African agricultural innovations are patriarchal in nature which further minimises women’s access to resources relevant to innovation. Other rights relate to the needs of women being overlooked during technological advancements.

Rights to properties like land and other natural resources are extremely important for rural women because their livelihoods depend upon them. These rights affect women’s bargaining power within the household and within the community and society at large and consequently have an impact on agricultural innovation and ultimately poverty alleviation, considering the key role women play in rural agricultural settings.

In relation to gender approaches to agricultural extension and training, agriculture has been perceived as a domain for men and extension services have side-lined women more generally during the training and visits (T&V) period. Later, the FAO and World Bank (2000), through the Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD) programme, placed emphasis on an integrated approach to agricultural education, research and extension.

Despite this approach, women remain underrepresented as scholars, extension agents, researchers and instructors despite evidence that agricultural productivity increases when women receive the same level of advisory services as men (Beintema 2010). It is important to note that the way the literature on agriculture and development has been reported tends to generalise gender while assuming that targeting the head of households (usually male) would automatically result in overall
economic prosperity. This may be true, but Quisumbing and McClafferty (2006b) note that even household members prefer to act independently when it comes to certain decisions, for example, those concerning resources. As Scoones and Thompson (1994) observe, the term ‘farmer’ is over-simplified in gender debates. In most cases the term ‘farmer’ is synonymous with ‘male’ in agricultural farming systems and is not gender-neutral. This generality takes for granted the unequal power relationships between men and women, even within households (Quisumbing and McClafferty 2006b). Moreover, interrelationships between the different gender groups tend to be reinforced by cultural beliefs and practices (Kakooza et al. 2005). It is also important to note that economic capacities and incentives are gender differentiated in ways that affect supply response, resource allocation within the household, labour productivity and welfare (World Bank 2005; Quisumbing and McClafferty 2006a). These gender differences have implications for research, extension and development outputs as well as innovation in terms of flexibility, responsiveness and dynamism. Another drawback relates to the scarcity of information in relation to gender and agricultural innovation. Very few scholarly materials have considered gender debates from an innovation systems perspective or even considered the impact of innovation on gender. In addition, very few development agencies have embraced this kind of thinking, which further justifies a study of this nature towards filling the existing gap.

Understanding the dynamic processes of change related to gender and agriculture is paramount in order to enhance faster and sustained agricultural growth. The gender patterns of these dynamics are important for growth and development of the agriculture sector, particularly in Africa where gender disparities tend to be greatest among the poor (World Bank 2001). Discussions seem to have been advanced from a technology development perspective, basically in terms of what women can do in development and vice versa (Buvinic and Mehra 1990). More importantly, the social dynamics embedded in technological processes seem to have been overlooked in many gender and technology studies. The interrelationships emanating from the social dynamics of a society form a significant component of social capital that drives technological developments. This aspect is emphasised by innovation systems scholars, who recommend a holistic approach to technological studies towards enhancing innovation capacities rather than technological capacities (Hall 2005). This further justifies a different approach to gender, technology and extension in order to incorporate the embedded diversities and challenges associated with requisite equitable social and economic impact. It emphasises the timely call to account for different roles of women and men towards dealing with gender inequalities that limit agricultural development through empirically informed gendered programmes for poverty reduction (World Bank, FAO, and IFAD 2009).

4. Linking Agricultural Development to Innovation

The majority of the world’s poor depends on agriculture for its livelihood. Mainstream development agencies have emphasised the need to rethink how the agricultural sector may be supported in order to enhance development and economic growth (DFID 2008; World Bank 2008; World Bank, FAO, and IFAD 2009). These agencies have been supporting agricultural research and development without any significant impact on the social and economic status of the poor. This may be
attributed to the linear nature of the processes of knowledge production and use (Clark 1995, 2002). This has prompted calls to change the traditional ways of engaging in research and extension towards a practice that embraces the process, not only as a technological process, but also as a social process (Hall et al. 2010). A number of scholars identify several reasons why this new approach would enhance development through the reconceptualisation of this process as an innovation. Referring to agricultural innovation, the World Bank (2006, 18) distinguishes inventions from innovation, noting that innovation encompasses the factors affecting demand for and use of knowledge in novel and useful ways. Hall (2010) further notes that innovation involves blending of both tacit and codified knowledge emanating from diverse sources within and outside research domains. In addition, innovation is a social process of learning, with capacities to engage in meaningful innovation being built over time. Oyelaran-Oyeyinka (2005) argues that the social process characterised by knowledge creation and exchange is shaped by the institutional structures in which it is embedded. These arguments notwithstanding, many scholars agree that important features of an innovation process include putting knowledge into use, whether it is new, accumulated or simply used in a creative way; is facilitated by diverse actors and interactions between them; and shaped by institutions, practices, behaviours and social relations that direct scientific and technological patterns, purposes, applications and outcomes.

The conditions and opportunities for innovation are, however, affected by the political economy of knowledge and globalisation challenges that demand well thought out institutional arrangements (World Bank 2006). This being the case, there is a need for a radical shift in how one thinks about and performs innovation (STEPS Centre 2010). Questions arise as to how one ought to organise rural innovation in order to target improvements in agriculture and how this can contribute to rural development and reduced levels of poverty. This largely depends on the sort of organisational configurations (networks, partnerships and alliances), institutional settings (routines, norms and practices) and policy environments; and how they are organised to support agricultural research and innovation (World Bank 2006). This is a daunting but important task for development policy researchers and analysts. It becomes even more problematic with the emerging understanding that unequal distribution of resources among men and women at the production level has contributed to the persistently low poverty levels in Africa (World Bank 2008). A policy tool that addresses these diverse challenges, while maximising the available innovative opportunities for men and women, will be necessary.

5. Analytical Framework for Integrating Gender in Agricultural Innovation

The social construction of gender highlights the dynamic and constantly changing aspects of gender. The gender-based practices and ideas are largely directed and influenced by varying cultural, political and economic factors, which include the household, markets and governance structures (World Bank 2001; Bardasi et al. 2007). Thus, gender as a source of knowledge and power differentials that shape actors’ behaviour with respect to access to differing resources can serve as an organising tool for innovation (Padmanabhan 2002). In this section, different analytical tools and how they have been applied in literature to address the gender variable are explored.
(a) Early Attempts to Integrate Gender into Innovation

Participation for a long time has been a key element of the integrated knowledge generation and dissemination tool, particularly in rural agricultural settings. Farmers, for instance, were encouraged through public extension services to adopt new technologies developed by research institutes—a move that was expected to translate into economic development and reduced poverty. Participation promoted increased interaction between purported knowledge suppliers or researchers and knowledge users, such as farmers (although farmers are themselves useful sources of indigenous knowledge), and such interactions also generated important tacit knowledge. A systems approach to agricultural development was being considered as a result of the realisation that participation would only work if the institutional environment in which innovation occurs is supported (Biggs 1990). An example of such early systems models is the Agricultural Knowledge and Information System (AKIS), which is based on knowledge economics emphasising linkages, generation and diffusion of information (Röling and Engel 1992). Later, FAO and the World Bank developed the AKIS/RD (Rural Development) programme which adopted a systems and integrated approach to agricultural education, research and extension (FAO and World Bank 2000).

AKIS/RD links people and institutions to promote mutual learning and generate, share and utilize agriculture-related technology, knowledge and information. The system integrates farmers, agricultural educators, researchers and extensionists to harness knowledge and information from various sources for better farming and improved livelihoods. This integration is understood as ‘knowledge triangle’ where farmers and other rural people are partners within the knowledge system, not simply recipients. (FAO and World Bank 2000, 2)

Just like other systems-based knowledge transfer models, this approach takes cognisance of the complexity of knowledge production, multiple actors and related networks facilitating knowledge production and dissemination. The success of knowledge-based tools like AKIS depends on how inclusive it is in terms of incorporating the interests of various individual actors—both men and women—at different points along the agricultural production value chain. The challenge with these models was how to improve the benefits of agricultural research and development and extension for women and other marginalised groups of the rural community. Figure 1 synthesises the gender dimensions of such systems.

The challenge of inclusion notwithstanding, the marginalised groups are threatened by the changing political and knowledge economy under which agricultural technologies are developed (World Bank 2006). This includes, for instance, the rising demand for high-value crops and livestock products prompted by new markets and new standards requirements, among other things. These changes demand a new institutional infrastructure to accommodate the unprecedented ever-changing scenario while also taking into consideration the specific needs of each gender group.

Although the AKIS approaches promote the farming systems perspective that considered intra-household gender relations and differences with regard to roles and responsibilities in agricultural production, they failed to reconcile the power relations pertaining to decision-making. For example, men, as heads of households, made most of the decisions, thus cutting out the contribution of women as key stakeholders.
and actors in agricultural production (World Bank, FAO, and IFAD 2009). In addition, the different forms of participation must create an opportunity for continuous learning to accommodate the unprecedented change, dynamism and complexity of innovation systems (World Bank 2006). Holistic AKIS models lack a place for different understandings of actors and do not pay any attention to cultural and historical contexts in which innovation thrives (Hall et al. 2001). Clearly there is a disconnect between the knowledge production process and the dynamics involved in it, including the practices of actors and the environment (institutional, regulatory and policy) under which the process is advanced as well as the nature of interactions (World Bank 2006). In addition, embedded learning is not utilised adequately to influence change related to gender. An approach that would deal with the complex agricultural production systems and the embedded non-technological processes (social, institutional and policy) is needed. This approach is expected to take cognisance of the interests of small-scale farmers, both men and women, and create opportunities for them to engage in new technological innovations, including high-value agricultural production, and enter competitive new markets.

(b) Rethinking the Innovation Systems Framework as a Knowledge-Based Tool for Analysing Gender Issues

The early participatory technology development models embraced participation tools to enhance inclusiveness of all farmers in the research, extension and development process (Mohan 2001). This made it possible to undertake gender analysis and subsequent efforts enhanced inclusive participation as well as integration of local knowledge and scientific knowledge. This was primarily aimed at promoting better acceptance and adoption of technologies by farmers. The AKIS approaches promoted the gender component through greater client participation and provision of incentives (see Figure 1 and Table 1). In this context, it was possible for specific

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**Figure 1.** Gender and knowledge systems.

needs of gendered groups to be considered. As mentioned previously, these models were, however, not translating knowledge into economic gain in terms of reducing poverty and enhancing social impact among potential beneficiaries.

Based on the foregoing discussion, it is logical to state that the disconnect between translation of research products into development and social impact is largely due to inappropriate policy approaches and tools that are expected to guide this complex innovation process. A systems-based framework that could address the shortcomings alluded to above is one that adopts innovation systems principles. From an

**Table 1.** Comparison of approaches to agricultural innovation and gender.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Participatory methods</th>
<th>Agricultural innovation systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Strengthened communication and knowledge delivery services to people in the rural sector</td>
<td>Strengthened capacity for innovation throughout the agricultural production and marketing system</td>
</tr>
<tr>
<td>Actors</td>
<td>National agricultural research organisations, agricultural universities, extension services, farmers, NGOs, and entrepreneurs in rural areas</td>
<td>Potentially all actors in the public and private sectors involved in the creation, diffusion, adaptation and use of all types of knowledge relevant to agricultural production and marketing</td>
</tr>
<tr>
<td>Organising principle</td>
<td>Access agricultural knowledge</td>
<td>Using knowledge in new ways for social and economic change</td>
</tr>
<tr>
<td>Nature of capacity strengthening</td>
<td>Strengthened communication between actors in rural areas</td>
<td>Strengthened interactions between actors; institutional development and change to support interaction, learning and innovation; creation of an enabling environment</td>
</tr>
<tr>
<td>Markets</td>
<td>Low market integration</td>
<td>High market integration</td>
</tr>
<tr>
<td>Gender inclusion</td>
<td>Improved inclusion</td>
<td>Full engagement of actors</td>
</tr>
<tr>
<td>Research agenda</td>
<td>Becoming more gender-sensitive because of greater participation of farmers</td>
<td>Becoming more gender-sensitive because of greater engagement of farmers but must have explicit gender dimension</td>
</tr>
<tr>
<td>Role of women</td>
<td>Women are seen as active participants in the process</td>
<td>Women are seen as critical actors</td>
</tr>
<tr>
<td>Gender focus</td>
<td>Focus is on gender difference in access to technology and services and on participation and representation in the research process</td>
<td>Focus is on gender difference in leadership and capacity to influence policy-making processes; social dimension and market linkages are made stronger but must ensure gender inclusion</td>
</tr>
<tr>
<td>Institutionalising gender</td>
<td>Personnel policies and gender balance in relevant institutions are improved; building capacity for women scientists and farmers’ organisations is the focus</td>
<td>Institutional development is created to support interaction and to ensure full engagement in policy-making processes but must have explicit gender dimension</td>
</tr>
</tbody>
</table>

*Source: Adapted from World Bank, FAO, and IFAD (2009, 259).*
innovation systems perspective, innovation is conceptualised not as a linear technological process, but as a social process that recognises and integrates the different sources of knowledge, culminating in economically useful new processes and products (Edquist 1997; Spielman 2005). An innovation systems framework helps us understand innovation processes and capacities at different levels (World Bank 2006; Hall et al. 2003; Clark 2002; Spielman 2005). This process is orchestrated via interactions among diverse players in the economic system, the roles they play and the way these interactions direct the transmission and use of ideas. Consequently, this enhances learning and innovation. Through this approach, the roles of different innovation agents, the types and nature of interactions between them, and formal and informal institutions that structure the innovation processes can be analysed (Edquist 1997; OECD 1997; Spielman 2005). The institutions play a pertinent role in this process. This is because the opportunities faced by the poor are largely influenced by the interactions of economic institutions with formal and informal political, social and cultural institutions (Berdegue 2005).

The innovation systems perspective has been applied to understand agricultural systems and helps us look at the totality of the systems from the production level to the market.

An agricultural innovation system (AIS) is a ‘network of organisations, enterprises and individuals focused on bringing new products, new processes, and new forms of organisation into economic use, together with the institutions and policies that affect their behaviour and performance’. The innovation system concept embraces not only the science suppliers but the totality of and interactions of actors involved in innovation as well. It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways. (World Bank 2006, vi)

The AIS concept stresses the importance of articulating agricultural development without undermining the political, social and economic dimension of knowledge creation, learning and innovation (Hall et al. 2003; Clark 2002). In a developing country context, this framework is debated from the perspective of fostering institutional capacities (practices, interactions, policies) for development while rethinking the role of different scientific and non-scientific actors as sources of knowledge (Clark 1995; Hall et al. 2001). According to the World Bank (2006), the diverse sources of knowledge are linked to actors and their interactions/linkages, generating both codified and tacit knowledge. The knowledge production process, including embedded learning, is significantly influenced by the institutional setting (practices, habits or way of doing things). Ultimately, this setting is shaped by the policy environment (rules, regulations, policies, and so on), markets, or infrastructure that could be enabling or constraining. The cultural setting and political environment play a significant role in shaping the behaviour of actors (Berdegue 2005; World Bank 2006). The AIS framework is considered to be an improvement of the participatory models mentioned previously (See Table 1).

AIS as an analytical framework is particularly suitable for analysing innovation through a gender lens because of its emphasis on institutions and actors that create ‘gendered’ patterns of interaction:
The AIS framework takes into account the many actors along the value chain, as well as diverse organisational forms that can facilitate education, research, and extension systems as well as practices, attitudes, and policies that frame agricultural production and trade. (World Bank, FAO, and IFAD 2009, 258)

Through exploration of feasible interventions that would enhance gender, the AIS framework gives space to different groups of agricultural innovators to access technology, inputs, services and markets, and to participate in influencing technological, institutional and policy processes. This is in addition to the fact that the framework promotes diversity, inclusion and participation needed to build social capital, which is crucial for a viable innovation system (World Bank 2006, 6).

Despite the richness of this concept in studying innovation and providing direction in building requisite innovation capacity for pro-poor innovation, there are practical challenges for agricultural development and sustained economic growth in a rural setting. The AIS concept, for instance, has been criticised in Spielman et al. (2009) and Spielman (2006), where it is argued that in addition to other weaknesses it does not take into consideration the non-farm innovation which must be considered when evaluating the overall performance of an innovation. These perceived strengths and weaknesses of the AIS framework notwithstanding, integrating a gender perspective into agricultural innovation is important because the involved institutional and organisational set-ups are themselves gendered. But where gender serves as an organising principle for innovation there may be implications for the efficiency and effectiveness of the innovation process. This is because gender can either challenge or reinforce existing social roles. There is insufficient empirical evidence and analysis regarding the role that gender relations play in innovation. Typically, the intersection between gender and agricultural innovation has not been explored with the sole aim of looking at how gender-oriented analysis can foster productive innovation, and how this can be used as a vehicle for gender equity.

(c) Understanding Innovation Capacity in Relation to Gender and Agricultural Innovation

Departing from participatory approaches to gender and the way they have been applied to explore gender and knowledge dynamics, we begin to think about interventions that may be required to promote gendered innovation through the building of requisite innovation capacity. This calls for a reconceptualisation of the entire process of knowledge production and dissemination and the working of AIS. The innovation capacity concept has been applied in AIS in reference to:

The context-specific range of skills, actors, practices, routines, institutions and policies needed to put knowledge into productive use in response to an evolving set of challenges, opportunities and technical and institutional contexts. (Hall and Dijkman 2006)

As mentioned previously, gender inequalities occur in rural innovation due to unequal or constrained access to resources (for example, land) and new technologies (for example, seeds) and access to information (for example, on market requirements that may be linked to poor extension services, poor social networks and literacy level,
among other things) (World Bank, FAO, and IFAD 2009). Capacities among rural agricultural communities are also embedded in formal and informal networks and interactions (Spielman et al. 2009). But the sort of capacities that promote gender equality may not be understood as well, considering that gender is also influenced by cultural factors and beliefs that are highly dynamic and constantly changing. Application of innovation capacity in gender and innovation studies is confounded by a number of challenges that must be given attention. These include:

- Dealing with acute market competition, considering the heterogeneity of rural-based farmer groups.
- Different sectors with diverse characteristics, which constitute the overall AIS.
- Fair representation of interests of diverse members, whether men or women, considering their heterogeneity.
- Measuring social change, resulting in increased involvement of women/men or socially excluded groups in different aspects of innovation systems, considering the multi-actor nature of many technological activities.

Exploration of the innovation capacity concept provides an expanding range of entry points for gendering innovation through new gender empowerment at a systems level (Figure 2). It also helps us begin to look at gender from a gender learning perspective. Figure 2 illustrates, from a systems view, the wide range of entry points that exist upon which innovation capacity can be built. Thinking about the existing and potential entry points has many advantages if one is considering gendering the

Figure 2. Gender empowerment at a system level.
innovation process. For instance, this may help identify channels or avenues through which the welfare of women can be enhanced. This is when compared with the old gender approach that only looked at various components of a system on an isolated basis.

Although this review article is not supported by empirical research, this holistic thinking on gender integration in an innovation system provides new insights that may productively generate debate on the gender and innovation interface towards influencing policy and practice.

6. Conclusion: Challenges for Analysis and Practice

This review of innovation and gender has revealed that there is a very large body of literature on the gender dimension of agricultural development. It is also noted that numerous guidelines and best practice documents have been produced; for instance, the work of many development agencies like the World Bank. While this article does not attempt to distil out what the contours of best practice might be, a number of themes seem to be apparent. These include: making greater use of gender analysis in planning and monitoring and evaluation; women’s empowerment and the enhanced participation of women in development programmes and other activities. This article has also reviewed current debates about agricultural innovation—particularly that of an innovation system—in an attempt to see if gender concerns could be integrated into activities that seek to promote innovation. While conceptual and empirical debates on AIS have been relatively silent on gender issues, the main argument in this article is that this concept provides new opportunities for taking note of gender concerns in innovation planning, including rural extension advisory services. A disclaimer is made here to alert the reader that this article adopts a review approach based on literature. It however opens up a new way of looking at gender in AIS. It proposes two critical aspects of the innovation systems idea that offer great promise and which require to be tested using empirical data collected from different settings.

(a) Shift from Gender Analysis to Gender Learning

The first is the emphasis that this idea gives to the importance of learning, both as a way of changing products and services, but also in terms of learning new ways of working to achieve different goals. This conceptualisation of learning is different from the learning described in development practice literature. As Johnson and Wilson (2006, 748) contend, learning is the process of knowledge attainment and generation. In addition, learning occurs as communities of practice engage in capacity building activities through shared learning (Johnson 2007, 277) and as they interact, they promote learning (Johnson and Thomas 2007, 46–47). What seems to be lacking in these debates is clarity about social actors’ practices, the social change and context that promote learning. The innovation system approach as an analytical framework provides a way of understanding the dynamism of learning and its implication for the innovation system considering that a lot of information is generated in a dynamic system (Clark 2002). These insights are crucial for gendering innovation systems, implying that ways to do this need to be learnt and by the same argument shaped by the local context in which this learning is taking place. This
suggests the need for a major departure from best practice as a guide on gendering innovation towards a learning-based approach on how best to achieve this. In practice, lessons from other approaches discussing gender can be used as a useful starting point, but what is more important is the quality of the learning process guided by a holistic view of the innovation system. Gender experts and analysts and managers and planners of initiatives may use gender analysis as an important mode of collecting information for the learning process. This is however irrelevant if it is not coupled with the reframing of practices and approaches by these actors.

Few projects, programmes and organisations have mastered and adopted these as routine practices for more general learning agendas. The reason may be partly linked to lack of or inadequate incentives to incorporate a gender learning perspective in these development initiatives. For the same reason that the issues of poverty have struggled to become guiding mission imperatives, gender learning will ultimately be limited by the institutional setting of development and innovation practice and the incentives this environment places on those that work there. What is very clear is that in the current institutional environment under which rural extension services are advanced, simply adding gender categories to data collection protocols will not lead to gender learning in innovation practice unless the incentive regime of those implementing the programme changes dramatically. It is questionable whether the market could provide the incentives for this sort of gender orientation. This leaves open the question of how public policy could achieve this goal. An initial analysis of what exists and has worked in terms of incentive regimes in different AIS needs to be undertaken as a starting point. This analysis should be tailored to capture whether gender learning is more profound in those circumstances.

(b) Shift from Women’s Empowerment to Systems’ Empowerment

Following on from the above discussion of the factors that could restrict gender learning, the second point of value in the innovation systems perspective is the emphasis that the concept gives to the wider notion of innovation capacity. As defined earlier in the article, this view of capacity goes beyond skills and actions of individuals, but encompasses the behaviour of the system as a whole and is shaped largely by the policy and institutional dimensions of that system. While ideas such as women’s empowerment and participation and the reduction in gender inequality, among others, are laudable objectives in themselves, like gender analysis, they have restricted usefulness unless the factors affecting the whole system in which they are located are addressed (compare this with the discussion of participatory methods and systems constraints in Hall and Nahdy 1999). More positively, understanding innovation capacity in a more systemic sense reveals many more entry points through which gender concerns can be addressed (see Figure 2). These entry points are in the policy domain, the institutional domain, in the market domain, the research domain, extension domain and in the financial domain. This expanded set of entry points also emerges from the way the innovation system reveals critical processes that can be gendered: partnering; modes of interaction to share information for innovation; and the roles of actors in different innovation-related tasks including extension services (for example, does the gender of the extension agent matter?). For most rural-based extension services that have viewed gender awareness as an ‘end of the pipeline issue’ the implications are clear. More focus needs to be
placed on strengthening the wider dimensions of innovation capacity, and each of the
different entry points that this suggests offers opportunities for introducing gender
awareness. The analytical implication of this is that gender analysis needs to take
place at a systems level.

As an illustration, if patterns of interactions (for example, informal networks like
women groups) are identified as an entry point in an innovation system, then this
would be used as a platform for addressing many challenges that impact women’s
access to resources (information, extension, advisory services, education, group credit
facilities, and so on). The same platform would provide an opportunity for women to
build human and social capital and increase capacity to participate in decision-
making (for example, decisions on production and marketing). The networks’
activities can further be re-enforced by information and communication technology.
All these activities are impacting women’s responsiveness to agricultural innovations.
This notion is built around the system’s empowerment rather than women’s
empowerment. The embedded multiple activities are accompanied by valuable
gender learning which further strengthens the subsequent working of the system.

Despite the above conclusion, analytical tools for exploring innovation systems will
need to be adapted to increase the sensitivity of the gender dimension of the rural
extension service that takes cognisance of the needs of different groups, including
women. For instance, the different entry points alluded to above provide pointers on
how this may be done.

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Notes

1 Gender learning refers to the way new experiences and local context should inform the process of making
the agricultural innovations, including extension services, gender sensitive. This definition is drawn from
innovation system literature where learning is seen as a way of changing products and services through
conceptualisation of new ways of working to achieve different goals (Clark 2002; World Bank 2006).

2 This suggests that women are disproportionately represented among the disadvantaged poor, and the
poorer the family, the more likely it is to be headed by a woman (World Bank 1989, iv).

3 This a globally accepted approach to promoting gender equality and equity and involves incorporating
gender perspectives in all policies, programmes and projects to ensure that they impact on women and
men in an equitable manner. Although gender analysis reveals the disparities in terms of who is
disadvantaged, some sectors such as agriculture and regions with high poverty levels and gender
mainstreaming may need to target women in order to bring about gender equality (Commonwealth

4 The Canadian International Development Research Centre (IDRC), through its Innovation, Technology
and Society (ITS) Program has been supporting research since 2006 on a series of inter-related Science
Technology Innovation (STI) issues that can contribute to the enhancement of innovative capabilities,
policies and institutions to support just, equitable and sustainable social and economic development in
developing countries (see http://www.idrc.ca/its).

5 Institutions include social norms of behaviour, habits, routines, values, aspirations, laws and regulations,
all of which are social constructs rooted in the history and culture of a given society (Berdegué 2005, 9).
Communities of practice are groups of people who have a common interest and are engaged in a shared enterprise, through which they both have, and further develop, a repertoire of knowledge, skills and practices (Wenger 1998, cited in Johnson 2007).

This conceptualisation of capacity from an innovation system perspective departs from the other definitions that adopt a narrow view. The World Bank (1997), for instance, takes a developmental view and defines capacity as the people, institutions and practices that enable countries to achieve their development goals. For broader understanding of this concept in the extension literature, see Photakoun (2010).

References


