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GENDER AND AGRICULTURAL INNOVATION: REVISITING THE DEBATE THROUGH AN INNOVATION SYSTEM PERSPECTIVE

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DISCUSSION PAPER SERIES

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GENDER AND AGRICULTURAL INNOVATION: REVISITING THE DEBATE FROM AN INNOVATION SYSTEMS PERSPECTIVE

Ann Kingiri¹

Abstract

This paper is an attempt to bring together two major streams of debate and policy analysis, which could make a major contribution to equitable development. The first concerns gender issues and how they relate to achieving both equity and efficiency goals. The second concerns innovation in agriculture and the way planning and policy is starting to view this as a multidimensional process driven by capacities distributed through society. This paper is being written in the context of a programme — the DFID-funded Research Into Use programme — that is exploring how research can be used for innovation and impact. The purpose of the paper is to reflect on the opportunities that a systems understanding of innovation provides for addressing gender issues and to provide some insight on what RIU might expect to achieve in this regard. The paper concludes with a call for two major shifts in practice and analysis: (1) A shift from gender analysis to gender learning and (2) A shift from women's empowerment to empowering innovation system capacity.

Key words: Gender, Women, Agricultural Innovation, Development, Agricultural Research, Policy, Africa

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LIST OF ACRONYMS

AIS	-	Agricultural Innovation Systems
AKIS	-	Agricultural Knowledge and Information System
AKIS/RD	-	Agricultural Knowledge and Information Systems for Rural Development
AWID	-	Association for Women’s Rights in Development
CIAT	-	International Center for Tropical Agriculture
CRT	-	Central Research Team
DFID	-	The UK’s Department for International Development
FAO	-	The United Nation’s Food and Agriculture Organization
GAD	-	Gender And Development Thesis
IDRC	-	Canada’s International Development Research Centre
ICRAF	-	World Agroforestry Centre
IFAD	-	International Fund for Agricultural Development
IFPRI	-	International Food Policy Research Institute
ILRI	-	International Livestock Research Institute
ITS	-	IDRC’s Innovation, Technology and Society programme
MDGs	-	Millennium Development Goals
NARS	-	National Agricultural Research Systems
NGO	-	Non-Governmental Organisation
OECD	-	Organisation for Economic Cooperation and Development
R&D	-	Research and Development
RIU	-	Research Into Use
RNRRS	-	Renewable Natural Resources Research Strategy

- STI** - Science, Technology and Innovation
- UK** - United Kingdom
- UN** - United Nations
- UNESCO** - United Nations Educational, Scientific and Cultural Organization
- UNIFEM** - United Nations Development Fund for Women
- WID** - Women In Development Thesis

1. INTRODUCTION

This paper asks how men and women, as well as socially-excluded groups of agricultural innovators, are represented in innovation. It also considers why gender issues are important in innovation debates. This is important as an effort to engender innovation towards harnessing existing opportunities and identifying gaps for learning and building requisite innovation capacities for pro-poor innovation (Berdegue, 2005). The paper is based on the understanding that women and men have different potentials and capabilities to influence economic change (World Bank, 2005; World Bank, 2007a). The discussion advanced in this paper takes cognisance of the diversity of innovation in terms of actors and their roles, as well as the context it takes place in, 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). Overall, this paper endeavours to address the following research questions:

- Are there gender biases in the way agricultural innovation studies are advanced? To put it in another way, is agricultural innovation engendered?
- What are the principles for an engendered innovation systems approach to research and use of agricultural innovation?
- How does the agency of women/men manifest itself in the agricultural innovation value chain?
- With regards to marginalised groups (e.g., 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?
- With the changing knowledge economy and technological developments, does gender promote or hinder knowledge and skills development for disadvantaged groups of people?
- What are the opportunities for policy to enhance improved contribution to the innovation process by different groups of farming communities?

I am well aware that this paper is far from being conclusive due to the lack of supportive empirical study, particularly with regard to agricultural innovations. It, however, 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 context in which this paper is being prepared is a programme exploring how research can be used for innovation and impact — the Research Into Use (RIU) programme funded by the UK's Department for International Development (DFID). The programme has established a series of experiments with different forms of innovation support. These include examples of business incubation as well as more explicit forms of innovation support services, such as the establishment and support of innovation platforms by country programmes. The purpose of the paper is to reflect on the opportunities that a systems understanding of innovation provides for addressing gender issues and to provide some insight on what RIU might expect to achieve in this regard — as well as identify what some of the gaps in practice and understanding might be. Although RIU has undergone shifts in terms of its underlying conceptualisation, innovation systems thinking has played a large role in shaping its operational approach and management style from the beginning. This review of gender and innovation discourses aims to stimulate debate within the programme on the way gender is being addressed and on the possible need for mid-course corrections.

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. This subject forms a substantive part of the subsequent sections. Section 5 explores the justification for investigating gender in innovation studies. Section 6 attempts to understand the sort of analytical framework that would accommodate the diverse components and elements of gender and innovation.

The paper concludes with call for two major shifts in practice and analysis: (1) A shift from gender analysis to gender learning; and (2) a shift from women's empowerment to empowering innovation system capacity.

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 the 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. GENDER DIMENSION OF DEVELOPMENT: ANALYSIS OF TRENDS AND 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. These include the various arms of the United Nations — including the Food and Agriculture Organization (FAO), United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Development Fund for Women (UNIFEM) and Gender Advisory Board of the UN Commission on Science and Technology for Development — the International Fund for Agricultural Development (IFAD) and the World Bank among others. These agencies have individually or in collaboration documented information on gender in relation to agriculture, development and poverty. Others who have done so include various research centres undertaking research on women and gender, such as the International Center for Tropical Agriculture (CIAT), Association for Women's Rights in Development (AWID), specific funding agencies such as Canada's International Development Research Centre (IDRC) and the UK's Department for International Development (DFID). The available literature explores gender issues in relation to agricultural development, food security, poverty reduction, women and development, more generally.² This literature 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 is followed by a synthesis of the relationship between gender and the Millennium Development Goals (MDGs) development variable. 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

² The feminist theorists have also published on gender and development, sometimes criticising how this subject has been approached by development theorists (Jackson, 1996). These strands of arguments linked to gender and feminism, although important, are not within the scope of this paper.

Women In Development (WID) thesis on the one hand, and Gender And Development (GAD) thesis on the other. The Women In Development 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 Women In Development concept was limited to the context of human rights (see the work of the United Nations Commission on the status of women). Actual developmental agenda that dealt with concerns of women started in the 1970s. It was around this time that Ester 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 1976-85 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, 1996). 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”³ by implying that all households headed by women are poor, which is erroneous as the “subordination of women is not caused by poverty” (pg 501). She proposes that rescuing gender from the poverty trap requires poverty-independent gender analyses and policies.

The other perspective on gender — Gender and Development (GAD) — revolves around the realisation that development may not happen without 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.⁴ 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).

³ 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).

⁴ 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 Secretariat, 2001; UN, 1997).

b) Gender and MDGs

Among the policy instruments that have triggered reconceptualisation of gender are the 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 regards to achieving sustainable development (World Bank, 2007b; 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 World Bank (2007b) 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).

Attainment of MDGs has been pegged to proper administration of Science, Technology and Innovation (STI) goals (Juma and Lee, 2005). Consequently, gender debates have moved to a higher level where development and poverty are analysed from science, technology and innovation perspectives (World Bank, 2008; UNESCO report, 2007; World Bank, FAO and IFAD, 2009; Sujatha, 2008; Blake and Hanson, 2005). This direction is spurred by a better understanding of complex social and institutional environment under which innovation occurs. Moreover, the role of gender in development only becomes vivid when one looks at

social change at different levels of the innovation system. This being the case, the MDGs as development indicators cannot singly provide pointers towards the relationship between gender and innovation.

c) Gender, Agriculture and Development

Many reports have discussed extensively the relationship between gender, agriculture and development. 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 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 engendering development and fighting poverty (World Bank, 2001).

The 'Gender in Agriculture Sourcebook' (World Bank, FAO and IFAD, 2009) has brought out 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, 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 socio-cultural 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 under different contexts. Firstly, rural communities have significant impacts linked to 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 regards 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 the 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). In conclusion, men and women differ in their access to, and control over inputs, productive resources and services, which limits the opportunities of men and women to participate productively in agricultural development (Bardasi et al., 2007).

Secondly, 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 et al., 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, 2007a). 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, 2007a). 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, tending, harvesting and threshing (World Bank, FAO and IFAD, 2009:522). In DFID (2007), it is argued that improving access to requisite resources (for e.g., 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 feminisation of poverty approach discussed previously.

It is important to note that the way the literature on agriculture and development has been reported on 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 decisions around 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 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 thinking⁵, 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 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 and technology in order to incorporate the diversities and challenges associated with interface between the two in terms of 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 engendered programmes for poverty reduction (World Bank, FAO and IFAD, 2009).

⁵ The Canadian International Development Research Centre (IDRC), through its Innovation, Technology and Society Program (ITS) has been supporting research since 2006 on a series of inter-related 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 www.idrc.ca/its).

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 Research Strategy 2008-2013; 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 doing research towards a practice that embraces the development 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 research into use 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 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 Manifesto, 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 on the available innovative opportunities for men and women, will be necessary.

5. GENDER AND WHY IT MATTERS IN AGRICULTURAL INNOVATION STUDIES

There is an abundance of literature that brings out the possible negative effects of ignoring the different roles adopted by men and women in the innovation processes linked to rural agriculture. Indeed, it has been shown that reducing gender inequality in Africa could significantly improve agricultural production and poverty levels (FAO, 2007b; World Bank, 2008). From innovation studies research, it is now clear that both social and technological processes are important for putting research into use. What is important to point out is the highly-gendered nature of these processes. The dynamics around different activities and roles that poor communities engage in towards addressing their social and economic needs through agricultural production systems epitomises the gender dimension of agricultural innovation. Notably, agricultural innovation systems target poor farmers and consumers, based on their understanding of the working of systems they are involved in. This is value-based and is also impacted by social norms. Further, the decisions pertaining to innovation processes have a bearing on social notions and are also value-laden. These are areas that are bound to have gender differences (Berdegue, 2005). Crowden (2003:9), quoting Kirkup and Keller (1992), highlights the gender dimension of technological processes while giving an illustration of how women may be a disadvantaged gender:

“Whether a particular technology is done primarily by men or women almost always depends upon where the technology fits into pre-existing cultural notions of what is appropriate to each gender. Women can be and are excluded from certain technologies for a variety of reasons and rationalizations: they are thought to ‘lack’ such characteristics as bodily strength or intellectual capacity; certain activities are seen as threatening a woman’s ‘natural’ role; women have less access to education, tend to be less experienced and less assertive to gain experience and training; education and training may be unfriendly.”

Other reports have also noted that although women are key actors in technological processes, they are disadvantaged more in terms of exercising their potential to contribute to the innovation process (World Bank, 2001; UNIFEM, 2005). It is this gender inequality that key development agencies have focused on:

“Promoting gender equality is thus an important part of a development strategy that seeks to enable all people, women and men alike, to escape poverty and improve their standard of living”

(Word Bank, 2001:1).

To heed this call and address gender issues in research and development — thereby promoting sustainable development and substantial poverty reduction (UNIFEM, 2005; World Bank, FAO and IFAD, 2009) — efforts must be made to engender innovation processes. The available literature, however, does not provide any direction on how gender should be integrated into the new thinking around innovation processes. Arguably, in the emerging discussions around agricultural and rural innovation, gender as a variable is not accorded adequate space from the theoretical point of view.

This paper attempts to address this omission and thereby contribute empirically to the scarce but growing scholarship around engendering technological innovation for sustainable development (World Bank, FAO and IFAD, 2009).

Understanding the Gender Gap in Gender and Innovation Studies

This paper has largely been informed by a critical analysis of literature around the subject of gender and innovation in agriculture development. It was inspired by the growing interest in studying innovation for economic growth on the one hand, and the parallel debates on gender, on the other. The gender dimension of innovation is slowly gaining importance (Blake and Hanson, 2005; Sujatha, 2008) but the topic in the field of agriculture still remains unexplored (Thomas, 2003). The available literature seems to indicate certain possible sources of gender bias in studies measuring innovation. Innovation studies, for instance, do not generally take into account or explicitly seek out the views of women about innovation processes or their roles in innovation, and they do not consider the possibility that women’s and men’s contributions to innovation may differ (Crowden, 2003). Thus, gender bias may result in the exclusion of women from participating and benefiting from the innovation processes. Ranga and Etzkowitz (2010:3) note that innovation points towards the

functioning of institutions and organisations; and tends to ignore the gender dimension embedded in individual innovators:

“The gender dimension of innovation is usually considered as a peripheral element of the (innovation) process, which narrowly focuses on issues like the exclusion/inclusion of women in research and development, invention and innovation.” (Ibid)

They further argue that innovation is inherently gender-biased as opposed to being gender-blind, due to the social perception of technology linked to men rather than women. Crowden (2003:10) points out that women are seen merely as passive recipients of technology rather than active participants in its development. These arguments disagree with the reports that repeatedly present women as major drivers of technological innovations, particularly in sub-Saharan Africa (World Bank, 2008).

Notably, it is now accepted that science and technology has to be accompanied by innovation if the poverty reduction Millennium Development Goals (MDGs) were to be realised (Juma and Lee, 2005). This is because innovation thinking make us focus not only on new ways of doing things, but also on the related range of new ideas, institutions, practices, behaviours and social relations that shape the application of science and technology (Edquist, 1997). Innovation, in particular, embraces the continuous use of new or/and existing knowledge for economic usefulness (Hall et al., 2003; Spielman, 2005). But how this is articulated will depend on how people perceive and practice innovation (STEPS Manifesto, 2010) and on the building of requisite capacity to innovate. Research in agriculture and development has received a lot of attention, mainly due to the slow pace experienced in translating research into use to benefit poor communities (Hall et al, 2003). However, literature targeting this area has not considered the gender dimension of innovation. But this is not to imply that agro-technological approaches have been gender-blind. Indeed, debates around gender and agriculture are widely reported in the right of enhancing development through improving participation capacities of marginalised groups of poor farmers (Engel, 1995; 1997).

6. 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, I explore different practice tools and how they have been applied to address the gender variable.

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 out 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 Systems (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 a programme — the Agricultural Knowledge and Information Systems for Rural Development (AKIS/RD) — which adopted an 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. 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 for women and other marginalised groups of the rural community. Box 1 below synthesises the gender dimensions of such systems.

Box 1: Gender and Knowledge Systems

- Both men and women manage sectors of complex smallholder production systems
- When gender is ignored, there is a cost to people’s wellbeing and to sustainable growth
- Knowledge is not transferred; it is generated and exchanged in a continuous learning process
- Farmers, agricultural educators, researchers, extensionists, and traders form part of knowledge and information networks
- Rules and mechanisms governing the way different actors, organisations, enterprises and groups interact to supply and demand knowledge and technology are critical for equitable development

Source: World Bank, FAO and IFAD, 2009:258

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.

Although the AKIS approaches promote the farming systems perspective that considered intra-household gender relations and differences with regards 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 don't 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, the 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 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 Box 1 and Table 1, which follows later on in this section). In this context, it was possible for specific 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 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 the informal 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 process⁶. 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

⁶ 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 (Berdegue, 2005:9).

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 Agricultural Innovation Systems 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 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 etc), markets, 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 Agricultural Innovation Systems framework is considered to be an improvement of the participatory models mentioned previously (See Table 1 below).

Table 1: Comparison of Approaches to Agricultural Innovation and Gender

Themes	Participatory methods	Agricultural Innovation Systems
Purpose	Strengthened communication and knowledge delivery services to people in the rural sector	Strengthened capacity for innovation throughout the agricultural production and marketing system
Actors	National agricultural research organisations, agricultural universities, extension services, farmers, NGOs, and entrepreneurs in rural areas	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

Organising principle	Access agricultural knowledge	Using knowledge in new ways for social and economic change
Nature of capacity strengthening	Strengthened communication between actors in rural areas	Strengthened interactions between actors; institutional development and change to support interaction, learning, and innovation; creation of an enabling environment
Markets	Low market integration	High market integration
Gender inclusion	Improved inclusion	Full engagement of actors
Research agenda	Becoming more gender-sensitive because of greater participation of farmers	Becoming more gender-sensitive because of greater engagement of farmers but must have explicit gender dimension
Role of women	Women are seen as active participants in the process	Women are seen as critical actors
Gender focus	Focus is on gender difference in access to technology and services and on participation and representation in the research process	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
Institutionalising gender	Personnel policies and gender balance in relevant institutions are improved; building capacity for women scientists and farmers' organisations is the focus	Institutional development is created to support interaction and to ensure full engagement in policy-making processes but must have explicit gender dimension

Source: Adapted from World Bank, FAO and IFAD, 2009: 259

Agricultural Innovation Systems 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 engendered innovation through the building of requisite innovation capacity. This calls for a reconceptualisation of the entire process of knowledge production and the working of agricultural innovation systems. The innovation capacity concept has been applied in agricultural innovation systems 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)

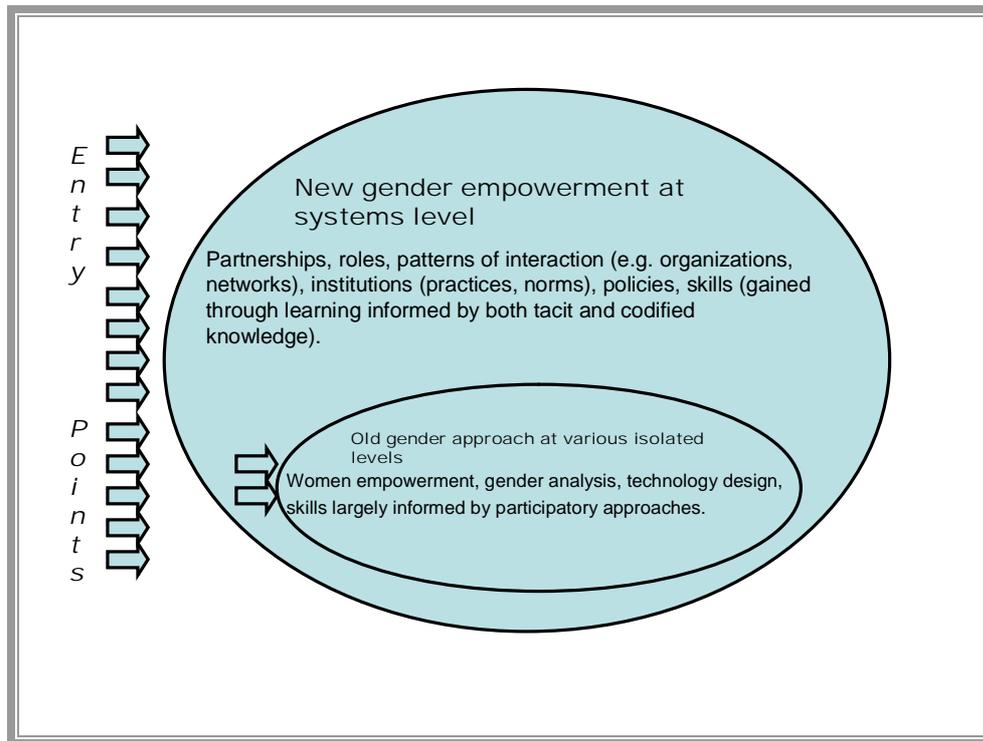
As mentioned previously, gender inequalities occur in rural innovation due to unequal or constrained access to resources (e.g., land) and new technologies (e.g., seeds) and access to information (e.g., on market requirements that may be linked to poor extension services, poor social networks, and literacy 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 agricultural innovation system
- 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 (Fig. 1). It also helps us begin to look at gender from a gender learning perspective. Figure (1) below 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 engendering the innovation process. For instance, this may help identify channels or avenues through which the welfare of socially-excluded or disadvantaged groups of agricultural innovators such as 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.

Fig. 1: Gender empowerment at a system level



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.

7. CHALLENGES IN ADDRESSING GENDER ASPECTS OF INNOVATION SYSTEMS

Understanding gender in the context of an innovation system

There is an emerging concern that gender dimensions — in the context of a system as well as with regards to innovation — has not quite been understood well. This complicates the process of gender analysis, which is aimed at greater efficiency in the innovation process through the use of analytical tools designed to better define who does what in the production system; and to align research and development priorities, resources, and user participation, accordingly (Goldey et al, 1997). Use of gender analysis as part of the agricultural research and innovation process will lead to a gender-sensitive approach to development as well as engendered innovation systems. Gender analysis in this new context must be learnt.

Relevant expertise

Previously, gender analysis was perceived as part of a social scientist's role. This is because gender is a social construct and gender analysis draws on social science tools like sociology, geography and economics. With new developmental trends that favour the system approach to research and development (World Bank, 2006), this has to change and different expertise might be required. While conducting this study, I found experts in gender generally did not understand the innovation concept and vice versa. In personal communications with gender experts, professionals from international research centres⁷ evinced a greater understanding of the emerging gender-innovation perspective compared to gender experts in national academic institutes (Jomo Kenyatta University and Egerton University, Kenya). A key tool for enhancing a gender perspective is incorporation of a gender analysis framework in any research programme or innovation process. Such a framework should enhance investigation of gender issues through the asking of relevant questions around who does what and with what resources, who has access to or control of the resources and benefits, and who should be included in agricultural research and development activities (Goldey et al, 1997). Analysis of the information generated by such

⁷ In this case the International Livestock Research Institute (ILRI) and Gender Diversity Center, World Agroforestry Centre (ICRAF).

questions becomes part of the overall analysis of the innovation system. This requires skilled expertise that is currently lacking.

Difficulties in selling innovation-gender agenda

Agricultural innovation systems are complex in nature, characterised by social and institutional innovations. Putting research products into use may only be realised via a private actor, champion or a broker or advancing innovation brokerage or negotiations among diverse stakeholders (Hall, 2010). It becomes even more problematic if this integrated and multi-actor process is to embrace the gender perspective. The proponents of either the innovation systems perspective or the gender debate may fear the complication of the research and development process by adding the gender perspective or vice versa. This, to compound to the problem of a lack of experts to articulate this agenda, as alluded to above. There needs to be far greater mainstreaming of efforts to deal with gender issues in innovation systems in addition to deliberate capacity building. This will also help legitimise the efforts of researchers already working on the gender-innovation subject. This might require extra funding and concerted efforts by actors interested in this kind of research.

Who should be responsible for gender and related implementation?

In participatory research and development, gender issues — including monitoring and evaluation — have largely been the responsibility of researchers implementing various projects. This was sometimes a requirement by certain funding agencies. With current knowledge-based models of research, the emphasis is on economic and social impact on the rural poor. While it is clear who the beneficiaries of technological innovations should be, less attention has been given to the intricacies of how these benefits are appropriated. This ostensibly may be linked to institutional failures (Berdegue, 2005) and thus may require an integrated approach with many players taking on responsibilities based on the issue of concern.

Gender information gap

There is no scarcity of literature on gender issues in all aspects of development. There is, however, scanty information related to interfaced gender and innovation research. This may be confounded by lack of access to certain literature sources that may require a subscription

fee. Another factor that may enhance this gap relates to interests, training background and assigned responsibilities. In most cases, researchers in programmes or projects have specialised disciplinary training and interests. In addition, they have been employed with specific roles and tasks in mind. Moreover, their work schedules may not allow for the exploration of gender or other unrelated research areas even if they are interested in the topic. Again this is an area that will require concerted efforts if this important research is to make any progress, particularly in the field of agriculture innovation.

8. 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. While this paper does not attempt to distill 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 enhanced participation of women in development programmes and other activities. This paper 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 agricultural innovation systems have been relatively silent on gender issues, the main argument in this paper is that this concept provides new opportunities for taking note of gender concerns in innovation planning. There are two critical aspects of the innovation systems idea that offer great promise:

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 to work differently towards different goals. By extension, the argument here is that ways of engendering the innovation process 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 a guide on engendering innovation towards a purposefully learning-based approach on how best to achieve this. Of course, in practice, guidelines can be used as a useful experimental starting point, but what is more important is the quality of the learning process. Gender analysis might be an important mode of collecting information for the learning process, but it will be irrelevant if it is not coupled with the reframing of practices and approaches by managers of initiatives. There is no shortage of tools (for example, see www.ilac.org) to assist with this sort of learning and reflection that could assist gender learning. However, few projects, programmes and organisations

have mastered and adopted these as routine practice for more general learning agendas. For the same reason that the issues of poverty and the environment 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 of programmes like RIU, 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 where 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.

b) *Shift from women's empowerment to systems empowerment*

Following on from the above discussion on 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. 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. So while ideas such as women's empowerment and participation are laudable objectives in themselves, like gender learning they have restricted usefulness unless the behaviour of the wider system in which they are located is addressed (compare with 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 1 in Section 6). These entry points are in the policy domain, the institutional domain, in the market domain, the research 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 engendered: partnering; modes of interaction to share information for innovation; and the roles of actors in different innovation-related tasks (for example, does the gender of intermediary agents matter?). For programmes such as RIU 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. Diagnostic tools for exploring innovation systems will need to be adapted to increase sensitivity of the gender dimension of the process these explore. Like many areas of development practice, shifting to these sorts of perspectives will very much come down to the willingness of individuals to adopt this sort of approach.

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