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Capacity for knowledge-based smallholder agriculture in Ethiopia Linking graduate programs to market-oriented agricultural development: Challenges, opportunities and IPMS experience

Improving Productivity and Market Success of Ethiopian Farmers

IPMS ETHIOPIA

Capacity for knowledge-based smallholder agriculture in Ethiopia: Linking graduate programs to market-oriented agricultural development: Challenges, opportunities and IPMS experience

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Table of Contents

List of Tables

List of Figures

Acronyms

ADLI—Agricultural Development-led Industrialization
AGP—Agricultural Growth Program
AET—Agricultural education and training
AR4D—Agricultural Research for Development
ARARI—Amhara Regional Agricultural Research Institute
CAADP—Compressive African Agriculture Development Program
CaSt—Capacity strengthening
CGIAR—Consultative Group on International Agricultural Research
CIDA— Canadian International Development Agency
CSOs—Civil Society Organizations
DAs—Development agents
EIAR—Ethiopian Institute of Agricultural Research
FGRA—Forum for Graduate Research in Agriculture
FYGTP—Five Year Growth and Transformation Plan
GDP—Gross National Product
GFF—Graduate Fellow Forum
GIS—Geo Information Science
GPs—Graduate Programs
GoE—Government of Ethiopia
HLIs—Higher learning Institutions
ICT—Information Communication Technology
IFPRI—International Food Policy Research Institute
IK—Indigenous Knowledge
ILRI—International Livestock Research Institute
IPMS—Improving Productivity and Market Success of Ethiopian Farmers Project
ITK—Indigenous Technology and Knowledge
MDGs—Millennium Development Goals
NARS—National Agricultural Research Systems
NGOs—Non Government Organizations
OER—Open Educational Resources
PLW—Pilot Learning Woreda
R&D—Research and development
SAFE—Sasakawa Africa Association
SSA—Sub-Saharan Africa
WALC—Woreda Advisory and Learning Committee

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Abstract

Graduate Programs in agriculture and allied disciplines in Ethiopia (henceforth the GPs) are expected to make concrete contributions towards achieving market-led and knowledge-based transformation of smallholder agriculture. To that end, strengthening capacities of the GPs and linking them to development deserve due policy attention. No panacea exists, however, as to how the programs can be better strengthened, linked, and become more responsive. Lessons from initiatives on the ground in the country and beyond are thus crucial to inform policy and the development of context specific innovative strategies. This paper aims to make a modest contribution to the discourse in Ethiopia and beyond on transforming GPs related to agriculture into 'developmental institutions'. The paper highlights the imperatives for knowledge-based transformation of smallholder agriculture in Ethiopia and emerging roles of GPs; discusses key challenges of the GPs to realize their mandates and to meet ever changing expectations.

It also presents a case study of an initiative by +aimed at linking GPs through research by students to commodity value chain development and actors, and discusses qualitative and quantitative indicators of outcome in terms of enhanced research and learning experience. The paper draws out some lessons and identifies strategic and practical options, including from the review of good practices elsewhere, that may help to improve learning and research in the GPs. The analysis shows that the GPs are currently facing several challenges, which could not be solved by government or by the programs alone, but rather require multiple linkages and collaborations. The GPs, on the one hand, need to be more proactive in creating linkages and partnering with regional and federal governments, and with development/interventions, and, on the other, actors who are truly committed to sustainability should be more willing to integrate systematically into development programs, as a critical component, partnering with and strengthening capacity of key capacity building national institutions, such as the GPs. Revitalizing the programs calls for holistic approach from an innovation systems perspective, multi-pronged and multi-level strategies, and long-term commitments.

Key words: *Ethiopia, agricultural transformation, knowledge, innovation capacity, graduate programs, engagement*

1 Introduction

The sense of urgency in Ethiopia today is more than ever about fostering sustainable development, to end poverty and hunger. Ethiopia is an agrarian country where around 95% of the country's agricultural output is produced by smallholder farmers (MoARD 2010). The contribution of agriculture to gross national product (GDP) (44%), employment (85%), export earnings (90%), and supply of industrial raw materials (70%) has remained high (World Bank 2010). Hence, the ability of the nation to address food and nutritional insecurity, poverty, and to stimulate and sustain national economic growth and development is highly dependent on the performance of agriculture. Yet achieving higher and sustained agricultural productivity growth remains one of the greatest challenges facing the nation (Spielman et al. 2010). Similarly, according to UNCTAD (2010), in many countries in sub-Saharan Africa (SSA) decades of concerted efforts by national governments, donors, and international and national development organizations have not yet led to sustainable agricultural productivity growth.[1]

The production systems in Ethiopia have remained subsistent-oriented, natural resource-intensive and low input–output rainfed systems. Within this context, market-led agricultural productivity growth is vital. Strategic shift in favour of knowledge-based transformation of smallholder agriculture is equally vital in dynamic demographic, economic and ecological conditions. There is increasing realization that Ethiopia and the rest of countries in SSA need new source of growth to propel their economy; and those contemporary challenges in agricultural systems—sustainable management of resource-base, climate change, and global competitiveness—require advanced knowledge to address. Enhancing agricultural knowledge base and facilitating its uptake and productive application is thus crucial. As we shall discuss, successful knowledge-based agricultural productivity growth, in turn, requires enhancing capacities at different levels—individual, organizational and systems—for learning and innovation. To that end, one, perhaps the most promising, pathway is repositioning and overhauling university academic programs in agriculture and allied disciplines. In particular, GPs need due attention to exploit their immense yet untapped potential to make meaningful contributions to development in several ways, both directly and indirectly.

From an innovation systems perspective, higher learning institutions (HLIs) along with agricultural education and training (AET) system are important, though not the only, source of knowledge and innovation. In developed and emerging economies, GPs

1. In this paper agriculture includes crop, livestock and natural resources.

sustain universities' research and development (R&D) activities. In Africa, universities have remained the central hub for capacity building and research (Teferra 2007); and have underutilized research potential and students who are 'an ever growing source of new ideas' (Etzkowitz and Dzisah 2008) and who could be trained and encouraged to become the next generation of innovators and entrepreneurs. Strong GPs are crucial to create corps of domestic professionals who would spearhead African AET systems for sustainable development (UNU 2009). Also, it is at graduate level that high level expertise are groomed in Africa for guiding policy, research, innovation and general vision for sustainable development (Ekwamu et al. 2009). Investing in strengthening GPs would have multiplier effects through 'training-the-trainers' capacity development for sustainability (UNU 2009), and can make especial contribution to creating and sustaining innovation capacities in agricultural systems.

Enhancing the capabilities and ensuring developmental relevance of GPs is becoming crucial for SSA to be able to realize existing potential and to adapt and respond to dynamic challenges and opportunities for the development of agriculture and rural sector. Strengthening the HLIs and AET systems in SSA entails realigning visions, mandates and practices (Davis et al. 2008) with changing development agenda and needs of stakeholders. In addition, reforms in HLIs should focus on fostering networks and partnership. Whilst the need for such a reform is no longer debatable, the challenge is when it comes to 'how'. Unfortunately, no panacea or blueprint, policies, strategies and mechanisms need to be designed, piloted, and adapted to specific contexts. Conceiving and implementing educational reform is difficult, complex, and needs nuanced understanding and experiential learning. In this regard, an initiative by Improving Productivity and Market Success (IPMS) of Ethiopian farmers' project to link research and learning in GPs to commodity value chain development may be informative from practical point of view.

The purpose of this paper is to make a modest contribution to the on-going discourse in Ethiopia and beyond in SSA as to how to ensure developmental relevance of GPs in agriculture and allied disciplines. Besides reviewing good practices and empirical literature, the paper presents and discusses experience of a development project, IPMS, in linking HLIs through graduate research to value chain development and chain actors as well as the benefits of such an arrangement. The next section provides background and rational, highlighting the imperatives for knowledge-based strategy for the transformation of smallholder agriculture in Ethiopia and the urgent need for strengthening and linking GPs to development. Section 3 presents research framework; HLIs reform agendas and approaches, and outlines the approach and methods employed in this action research. The results of the study are reported in Sections 4 and 5. Section 4 presents an overview

of the status of the GPs and the challenges they are facing to realize their mandates and to remain relevant to changing needs and environment. Section 5 presents IPMS experience with the relevant GPs and discusses outcomes of the initiative of the project on the basis of qualitative and quantitative indicators. Finally, in Section 6, we draw out lessons and suggest some practical and strategic options, including from the review of good practices elsewhere, to enhance the linkage between research and learning in the GPs and real- world and -time challenges.

2 Towards knowledge-based agriculture in Ethiopia

There is a consensus that market-oriented development of smallholder agriculture in SSA can be a critical pathway out of food insecurity, poverty, and a powerful tool to stimulate rural and national economic growth. Improving the productivity of smallholder agriculture in SSA makes direct contribution to the realization of the MDGs (Millennium Development Goals) in several ways (van Braun 2007). The Comprehensive Africa Agricultural Development Program (CAADP), under the New Partnership for Africa's Development (NEPAD) initiative, recognizes smallholder agriculture as the engine for economic growth in the continent. On the same breath, Ethiopia adopted Agricultural Development-led Industrialization (ADLI) in the early 1990s as an overall strategy for national economic development; and since then the country has been pursuing a policy, which is rural-focused and market-based development of smallholder agriculture.

As outlined in the recent policy document of the Government of Ethiopia (GoE), in particular the PIF (Agriculture Sector Policy and Investment Framework 2010–2020), Ethiopia is aspiring to achieve a middle income country status by 2025. The GoE has sketched recently a grand five year strategy (2010/11–2015/16) for economic development, FYGTP (Five-Year Growth and Transformation Plan), and, in line with it, the AGP (Agricultural Growth Program). The FYGTP recognizes the pivotal role of agriculture, and it aims to double the national economy by doubling agricultural output and to sustainably increase rural income and national food security. The specific objectives of agriculture and rural development component of the FYGTP encompass: i) achieving a sustainable increase in agricultural productivity and production; ii) accelerating agricultural commercialization and agro-industrial development; iii) reducing degradation and improving productivity of natural resources; and iv) achieving universal food security and protecting vulnerable households from natural disasters (MoARD 2010).

This section provides an overview of the challenges of transforming Ethiopian agricultural sector, along a sustainable commercial path. The section argues that strategic shifts in favour of knowledge-based approach for the smallholder agricultural transformation is becoming a necessity; and, towards that end, it underlines the urgent need for realigning and strengthening the GPs in agriculture and allied disciplines.

2.1 Agricultural transformation challenges in Ethiopia

Ethiopia is the land of promise with great potential and a comparative advantage in agriculture. The country is endowed with large and diverse plant and animal genetic resources; great yet mostly untapped irrigation potential (Awulachew et al. 2010); and agricultural land and highly diverse agro-ecology that are suitable for the production of a wide varieties of crops and for keeping different species of animals. And, more importantly, Ethiopia has a large pool of human resource with indigenous knowledge, which is vital to achieving sustainable agricultural development.

Ethiopia has been one of few countries in SSA with national government that has demonstrated unprecedented political will, backed by concrete commitment, to support smallholder agriculture, as a means to alleviate food insecurity, poverty, and to boost the sector's contribution to economic growth. Public investment over the past decade has been unprecedented in creating human capital, developing information and communication technology (ICT) infrastructure, electric power, and in road and other rural infrastructure to improve market access by smallholders and to enhance competitive advantage of the export sector (MoFED 2007). According to the MoARD (2010), agriculture and rural development sector accounted for about 15% of the annual public expenditure, far exceeding the CAADP target of 10%. Public provision of R&D service, extension advice, inputs and credit has been the dominant and preferred set of policy instruments. Yet the policy interventions have by and large focused more on cereal intensification and less on livestock development. This has been recognized in the recent policy direction of the GoE, which emphasizes the need for enhanced livestock subsector strategy.

Despite a decade of huge public investments as well as concerted efforts by donors and international development partners, the country has experienced little progress in terms of achieving higher and sustained agricultural productivity growth. For instance, the national average cereal yields (about 1.5 t/ha) remains one of the lowest (Spielman et al. 2010); and the total milk production from about 10 million milking cows was estimated at about 3.2 billion litres, an average of 1.54 litres/cow per day over a lactation period of about 6 months (CSA 2008). As the long-term trend confirms, cropland expansion remains the primary source of agricultural growth, and there has been little change in total factor productivity (World Bank 2005; Spielman et al. 2010). Although the sign of growth in land productivity in the past few years has been encouraging, little change in labour and total factor productivity means that real income of producers did not change significantly and that poor consumers did benefit little through a decrease in staple food

prices. Most of the factors held responsible for unsatisfactory performance of Ethiopian agricultural sector are policy- and institutional-related (Spielman et al. 2010). These include: aggressive promotion of standardized extension package in the face of complex, diverse and risk-prone production systems; lack of effective risk mitigation strategies; inefficiency in input and output market; and limitations with regard to tailoring policies and strategies on the basis of evidence on local contexts and opportunities as well as process and impact monitoring for policy adaptation.

In sum, the evidence implies that the country, though making a promising progress in recent years, has to still go a long way to reverse the long-term trend of growing rural poverty, deficient food production systems and a lack of food security, while sustaining the natural resource base. The FYGTP aims to double agricultural production to boost the economy mainly through increasing agricultural export. Further, the plan envisaged the transformation of smallholder production systems from subsistence to commercial with increasing diversification into high value products, as a means to rural poverty reduction. Yet the realization of the sought smallholder agricultural transformation will be more challenging than ever before. The objectives of the plan will have to be achieved within the context of:

- mounting demographic pressure set against diminishing natural resource base—both quantitatively and qualitatively (World Bank 2005), and expansion of the cropped area to more marginal lands, exacerbating land degradation (MoARD 2010);
- declining smallholder land holding[2] size, increasing 'land grapping' for Foreign Direct Investment (FDI), and competing land use needs for food, feed and biofuel;
- climate change (Admassie et al. 2008; Deressa et al. 2008) and emerging diseases; and
- increasing competition in export market with globalizing food value chain, and rising volatility in the world food prices (Spielman and Pandya-Lorch 2009).

Yet all is not as such gloom and doom. Indeed, modern science and technology are opening up new opportunities that would facilitate smallholder agricultural development even in marginal areas. Advances in basic sciences (Science Council 2005) and ICT (Juma 2009) were increasingly making new insights, tools and methods available that help to improve agricultural productivity, profitability, and ecological sustainability. For instance, the centres supported by the Consultative Group on International Agricultural Research (CGIAR) have through collaborative arrangements with national agricultural research systems (NARS) developed drought tolerant and disease resistant cultivars, conservation tillage technologies, irrigation technologies and management systems etc. (UNCTAD 2010). On the smallholder livestock front, it would be possible to significantly

2. In Ethiopian highlands per capita agricultural land holding is 0.20 ha.

improve productivity and efficiency through creative use of the already existing low-cost technological options, established tools, and through new ways of thinking about problems and doing business (Hall 2006).

Further, there are a number of emerging innovations which are geared towards creating enabling environment for technological uptake and addressing many of the non-technical impediments. These encompass alternative institutional and organizational arrangements for coordinated input/service development and delivery (Poulton et al. 2010; Spielman et al. 2010), index-based livestock insurance (Matsaert et al. 2010) and similar crop insurance systems for risk mitigation, innovative rural financial systems etc. Above all, nations can achieve a lot by enhancing the capacity of human resource—the most important determinant of development.

Globally, increasing knowledge[3] is driving the expansion of food production (McCalla 1998), food security and environmental sustainability (Acker 1999), and knowledge is a base for competitiveness in export market (Santiago et al. 2008). Within the context of emerging opportunities and challenges, the strategy for the transformation of Ethiopian smallholder agriculture must of necessity be more knowledge and information intensive. This is crucial for the country to circumvent the resource scarcity through improving efficiency in resource use, to produce marketable surplus, and to successfully adapt and respond to changes—climate or otherwise (Tesfaye et al. 2010). In the same line, technology transfer, trade and investment, in order of importance, seem to be the top priorities in the FYGTP, although not yet detailed and finalized. It is imperative to put in place different kind of policies, institutional arrangements, and pay greater attention to capacity strengthening to effectively implement the priorities and realize the objectives.

2.2 Renewed interest in agricultural higher learning institutions

It is now widely acknowledged that readily available global knowledge and technologies should be harnessed to resolve problems of productivity, profitability and sustainability in African smallholder agriculture (IAC 2004). As observed by Tesfaye et al. (2010), '*innovation is the process of successful use of knowledge, originating from various sources and acquired by various mechanisms for practical problem-solving*'. The innovation process may entail the application of new knowledge, but often it involves integration

3. There are different types of knowledge: technical or technological, organizational/managerial, institutional/policy, market-related/entrepreneurial, or combination.

and creative use of existing knowledge, incremental improvements in technology, organizational management, processes, and even creative imitation. Knowledge can be acquired in multiple ways, through research, experiential learning, and exchange based on market or non-market mechanisms (Spielman 2006; UNCTAD 2010). Ability to access from diverse sources and effectively apply technical, organizational, institutional and entrepreneurial knowledge is a *sin qua non* condition.

Enhancing human competences and organizational innovative capabilities are thus the prerequisites to access, and effectively apply and exploit emerging scientific knowledge and technology, along with indigenous knowledge (IK). Organizational innovative capabilities encompass ability to acquire, assimilate, transform and exploit knowledge (Zahra et al. 2006). According to Cohen and Levinthal (1990) organizational innovative capability includes 'absorptive capacity', that is, the '*ability to recognize the value of new, external information, assimilate it, and apply it to commercial ends'.* Such capabilities entail competencies such as 'new' knowledge and technology assessment skills, technical tool like effective utilization of ICT, and, more importantly, effective interaction both within an organization and with other organizations and actors (Hidalgo and Albors 2008).

The main challenge to technological advance of relevance to Africa is the lack of adequate innovation capabilities in the agricultural systems. Hence, knowledge-based development in the continent requires due consideration of all key aspects of capacity, including education and skill building (UNCTAD 2010). Similarly, the recent policy document (MoARD 2010) of the GoE states, 'most of the institutions that support the agricultural sector need capacity building, particularly at the regional and *woreda* levels'.

Cognizant of the emerging opportunities on the one hand and capacity challenges on the other, bilateral and multilateral development partners are shifting their priority in favour of domestic capacity strengthening. For instance, the recent Global Food Security Act of the United States of America (USA Senate Committee on Foreign Relations 2009), emphasizes the strengthening of innovative capabilities of agriculture-related higher education and NARS in developing countries. The international centres supported by CGIAR such as the International Livestock Research Institute (ILRI) and the International Food Policy Research Institute (IFPRI) have recognized the crucial role of domestic innovation capacity in agricultural systems and have accorded capacity strengthening as much attention as research and technology generation. ILRI explicitly recognizes the pivotal role of universities; and a recent study commissioned by ILRI (Kurwijila 2009) concludes, '*the long-term solution to address the continuous and dynamic nature of*

capacity strengthening needs is to develop sustainable capacity within the relevant organizations which are mandated to build the capacity of the various stakeholders'.

Capable HLIs in agriculture and allied disciplines in SSA are vital in providing human resource with the required quality, strengthening the knowledge base for sustainable agricultural transformation, and in fostering agricultural innovation systems at local and national levels. In particular, GPs are well placed to conduct research to adapt and/or generate knowledge, to strengthen capacity of extension service for knowledge dissemination, and to generate research-based evidence to inform dialogue on creating enabling policies and institutions (USA Senate Committee on Foreign Relations 2009). Thus, as Teferra (2007) rightly concluded, *'without strong graduate programs, it is simply impossible to establish a viable research culture and innovative capabilities in a nation'*.

With increasing recognition of the pivotal role of knowledge in development, comes increasing commitment to support HLIs. In Ethiopia, huge public investments have been made to create new universities,[4] upgrade former colleges and technical institutes to university status, expand old universities, and to increase staff number and upgrade their qualifications, develop ICT infrastructure and to improve laboratory facilities (Annex 1). Further, national system support agencies have been established, encompassing Higher Education Strategy Institute, Education Quality and Relevance Assurance Agency and National Pedagogical Resource Centre (Saint 2004; Belay 2007).

At the same time, however, HLIs, particularly GPs, in SSA are expected to efficiently utilize public resources for societal purposes and to deliver 'good value for money' through their training, research and outreach activities. Agricultural HLIs and their GPs in Ethiopia too are under immense pressure to make direct and concrete contributions towards the national endeavour for achieving food security, poverty reduction and overall economic growth through sustainable smallholder commercialization. Yet in Ethiopia, as elsewhere in the continent, building capable HLIs and GPs that are responsive to the needs of diverse stakeholders as well as proactively adapt to changes remains a challenge.

The increasing emphasis on developmental roles of HLIs implies that GPs need to establish networks with diverse knowledge sources, forge linkages, and closely work in partnership with farm households, agribusiness, agro-industry, policy, and state and non-state R&D actors. Yet, neither clear and actionable strategy nor sufficiently documented pilot initiatives exist to this effect. Furthermore, not much is known yet about the strategies and approaches which would be effective in re-orienting AET systems in SSA

4. There are 22 functional universities and 9 more universities are under construction (see Annex 1).

in general regarding their emerging roles and expanded developmental mandate (Davis et al. 2007). Nor is a proven universally accepted model available as to how GPs can be better linked and become more interactive, and thereby relevant and responsive. Hence, lessons from initiatives on the ground in the country and beyond are crucial to inform the development of enabling policy and the formulation of innovative and context specific strategies. The purpose of this paper is to make a modest contribution towards addressing this gap.

3 Research framework and methods

Realigning GPs and enhancing human and institutional capacity deserve due policy attention. This is important to leverage and optimize their potential to contribute to market-led and knowledge-based development of smallholder agriculture. It is equally important to enable the GPs to play a special role in the creation of national innovation capability in the agricultural systems and continuous capacity strengthening to ensuring dynamism. In addition to infrastructural investment (physical, laboratory and ICT) and upgrading staff qualification, making GPs more relevant and responsive calls for innovative strategies, including structures, mechanisms, processes and incentives. This is a blurred area calling for more explorations and innovations. To inform the current analysis, this section presents a review of selected literature dealing with the focus and approach in reforming HLIs, paying special attention to GPs in agriculture and allied disciplines. In addition, the research approach and methods employed in the current study are outlined in the same section.

3.1 Making graduate programs responsive

The paper focuses as an entry point on enhancing developmental relevance of graduate research. Nonetheless, graduate research cannot be seen in isolation. Human and institutional capacity, program structure, curricula and delivery method, and the overall philosophy and approaches to teaching and learning in GPs are all equally important to ensure relevance and quality. In Ethiopia, graduate research is an integral component of the overall research undertakings at colleges and university faculties of agriculture and allied disciplines, and often theses research projects account for higher share of time-bound research undertakings of universities. Research in GPs can contribute in addressing development and policy challenges if properly planned and implemented with the stakeholders. As put succinctly by Fear et al. (2006, cited in Bawden 2007, 19), *'academy need to engage with the citizenry and not just work for it or on it or extend out to it'.*

3.1.1 Reform imperatives and agendas

It is true that investment in agriculture-related GPs is worthwhile to the extent that the programs could contribute towards sustainable transformation of smallholder agriculture. Ethiopian HLIs and their GPs need to be transformed radically to become responsive to changing needs and remain relevant in changing environment. There has been a similar call across developing countries for HLIs to transform themselves into *'developmental*

institutions'; and to increase their contribution to development through the creation, transformation, adaptation and dissemination of knowledge **(**Sutz 2005**).**

In SSA, agricultural HLIs of the 21st century are expected to play the critical roles of technological gate-keeping and bridging the '*genetic divide'* and '*digital divide'* (IAC 2004). To serve these and other 'developmental' purposes, GPs should be deeply embedded into national productive and social sectors; socially networked—nationally and internationally—through a variety of formal/informal mechanisms (Bawden 2007). HLIs also need enabling policy and institutional environment; and internally, should have 'the right' governance, incentive, and organizational/institutional arrangements up and running.

Curricula for GPs should be relevant, interdisciplinary, flexible and dynamic; and methods of delivery need to emphasize interactive, discovery, and experiential learning (Acker 1999). The conventional curricula for GPs aimed at producing graduates who would be technical persons to be employed in the public sector as full time academics, researchers and bureaucrats are no more sufficient. The public sector alone can no longer absorb the dramatically increasing number of graduates. Sooner or later, graduates would be forced to find jobs in the emerging private sector, NGOs, and to establish their own enterprises and create wealth. The demand would increase in favour of less academic, more practical-oriented and innovative development practitioners and change agents (UNDP 2010). In the second place, knowledge workers with the capacity to manage and transform knowledge would be the type of graduates needed to meet societal demand in increasingly knowledge intensive economy (Zhao 2003).

The next generation of graduates should be entrepreneurs with communication, social and agri-business skills, and knowledge workers well equipped to tap into global knowledge and create new knowledge. Knowledge becomes economically and socially useful when it is productively applied. Hence, graduates should be able to transform and adapt knowledge acquired from diverse sources to resolve problems and support local development (Zhao 2003; UNCTAD 2010). Central to such innovation capabilities regardless of specialization is the learning aptitude and, basic ICT, networking and interpersonal skills.

In addition, the student population is being increasingly diversifying with increasing access to higher education. Graduate students would be more diverse in professional experience, extent of preparedness for the rigor of research degree, and in career goals. Flexible learning structure and curricula are important to cater to diversifying needs and to respond to changing environment of HLIs.

The ultimate test of 'developmental' HLIs and their GPs is their ability to produce '*new generation'* of professionals who are not just technically competent but are also entrepreneurs, capable of creating jobs (Juma 2009). Moreover, developmental HLIs produce capable graduates who could fit well to emerging '*knowledge economy'* and '*knowledge society'* (Santiago et al. 2008), and provide demand-driven and effective knowledge services to private, civil society organizations (CSOs) and the citizenry at large (Bawden 2007).

3.1.2 Mechanisms and approach

At program level, the key elements to enhance developmental relevance and quality of GPs encompass:

i. innovation in curricula and delivery methods—instructional methodology, tools, methods and approaches;
ii. staff—number, qualification, research skills, awareness of local situation and priorities, and the extent to which the staff is at abreast of latest development in agriculture and related disciplines;
iii. structure, mechanisms and processes for research problem identification, prioritization and implementation;
iv. the process and quality of supervision; and
v. evaluation of research output and communication to potential users.

Funding incentive to promote applied and problem-solving participatory and action research and putting in place functional and effective mechanisms for quality assurance at different levels are crucial (Materu 2007). Periodic tracer studies are informative as regard to whether the learning and research experience of the graduates is having the desirable influence (IFPRI 2009). Further, there are several experiences from developing and SSA countries to elucidate as lessons to be learnt relating to realigning and enhancing developmental roles of HLIs and their GPs.

First, GPs could be linked systematically to agriculture and rural development through community-based practical training and participatory action research. Such linkages would benefit all the parties involved (UNDP 2010): it would empower communities through enhanced capacity, active participation in needs articulation, better access to knowledge and services; the learners would acquire a better understanding of development challenges and would gain tacit know-how[5] and practical and soft skills;

5. Tacit knowledge (as opposed to formal or explicit knowledge) is knowledge that cannot be transferred to another person as a result of it being written down or verbalized. Tacit knowledge is not easily shared. Effective transfer of tacit knowledge generally requires extensive personal contact and trust. Tacit knowledge consists often of habits and culture that we do not recognize in us.

and the linkages could help HLIs to improve their contribution to agriculture and rural development, and to realign, on the basis of field research and feedback, their curricula, research and outreach activities.

Second, GPs can establish linkages and collaborative relationships with interventions and projects engaged in commodity value chain development. For instance, joint participatory diagnostic and action research can create opportunities for the students to better understand the performance and benefits to smallholders of specific commodity value chains.

Third, GPs could initiate proactively or participate in and benefit from research and innovation networks with the CGIAR centres, and foreign universities and research institutes. Global linkages and networks could be achieved through South–South, South–North or triangular cooperation arrangements. The latter includes EDULINK, the ACP–EU Cooperation Program in Higher Education ACP Secretariat (2009).

The modality of cooperation could take various forms. The focus may be institutional or faculty capacity strengthening, collaborative research or joint masters program or programs backed by advanced ICT (UNU 2009). The focus can also be strengthening existing GPs through innovations in curricula, instructional methods, teaching material development, creating and ensuring access to online Open Educational Resources (OER), and graduate course deliver and research supervision (IFPRI 2009). Regional and global networks and cooperation can strengthen internal capabilities of GPs, facilitate interactions that help the faculty to remain current and tap into global knowledge. In the long run, such linkages and cooperation can enable countries in SSA to develop the capabilities required to narrow the '*genetic divide'* and '*digital divide*', in other words, to facilitate technological catch-up (Bloom et al. 2005).

There are several other mechanisms and good practices elsewhere to draw on. Relevant experiences from Latin America (Juma and Yee-Cheong 2005) include: the Earth University in Costa Rica for innovative curricula and practical training to create leaders and change agents for sustainable development; the University of Campinas in Brazil for effective partnership with the private sector and transnational companies; and the University for Integrated Development in Colombia, illustrating the importance of partnering with NGOs. There are similar initiatives in Africa to link up GPs to rural communities (UNDP 2010). In Ethiopia, some agricultural collages have been working in partnership with the Sasakawa Africa Association (SAFE), and federal as well as regional governments[6] to strengthen public extension services by enhancing human

6. Ethiopia follows federal system, made up of nine autonomous regional states and two administrative cities.

capacity through custom-made degree program, emphasizing innovative approaches and community-based experiential learning (Tesfaye and Jemal 2006).

Yet building capable HLIs that are responsive to specific national context—history, stage of development etc.—is still challenging. As observed by Eicher (2006, cited in Davis et al. 2008), we need to avoid a 'one-size-fits-all' approach and adopt a long-term perspective in building responsive GPs. The innovation systems approach provides flexible and suitable framework for a nuanced understanding of the nature and process of overhauling HLIs and their GPs (Davis et al. 2008). The framework encourages a learning approach, piloting intervention and collective experiential learning through process and impact monitoring, to gradually arrive at context relevant strategy. Key to the framework is ensuring effective interactions; and appropriate incentive and supportive structure to encourage and facilitate proactive and productive intra- and inter-organizational interactions.

3.1.3 Graduate research relevance, quality, and supervision

Relevance and quality are key concepts in education- and research-for-development literature. Yet clear distinction is rarely made between the two partly because they are so closely related and two sides of 'the same coin'. Education quality assurance is considered critical for relevance (Materu 2007). Whether national or international standard should be used as a yardstick to measure quality is the other contentious issue in education and research. From an innovation systems perspective, education and research in HLIs should first and foremost serve, though with global perspective, regional/national economic, social, ecological and political needs; and thus should be contextualized and firmly grounded in realities of respective countries (UNU 2009).

The most common interpretation of quality in education and research is 'fitness-for-purpose', that is, the extent to which research, say in GPs, addresses local needs or produces outcomes of 'potential value' to regional/national development. However, others argue that the quality of research cannot be judged solely on 'potential value' as this does not guarantee whether scientifically robust method was used in the research and the findings were accurate.

For our purpose, the relevance of research in GPs by students and/or faculty can be seen from different perspectives and needs. Federal and regional policymakers of the country need knowledge and the support of policy-relevant research to put appropriate policies and institutions in place. Not just smallholder producers, but agribusiness and agro-

industry have to be supported as well by HLIs through research and outreach programs. Likewise, NGOs[7] active in agriculture and rural development and CSOs need relevant knowledge to effectively support the agricultural commercialization and transformation process. University faculties and colleges of agriculture and allied disciplines may have their own research thrust and priorities that they would like to achieve through graduate research. Last, perhaps most important, graduate research is a potent instrument in its own right in building capacity of the learners and helping them achieve their professional and personal goals. From the perspective of students, graduate research is a process of knowledge acquisition and utilization (Zhao 2003).

In summary, research relevance in GPs can be judged on the basis of the potential value of research outputs to regional and/or federal policymakers and to needs of intended users; and alignment to institutional research priorities and to capacity needs and professional goals of the learners. Research quality in GPs refers to whether the methods used were robust, the data were reliable and valid, analytical approach was sound, and research outcomes displayed adequate regional/national institutional context (Zhao 2003; IEO/IMF 2009).

The two key messages of the discussion over here are the critical importance of adequate knowledge about the needs of clients as an entry point and effective process management. The latter includes structure and process for setting research priorities, resource allocation, planning, and, in the context of graduate research, effective supervision. Zhao (2003) argued that graduate research supervision goes beyond the provision of academic research skills and research technique 'tool box'. Rather it is a process of 'knowledge conversion' whereby the supervisors foster and enhance learning, research and communication skills of graduate students. Further, supervision of graduate research, according to Zhao, is a knowledge management process; and its effectiveness, in terms of relevance, quality and timely completion rate, can be enhanced by employing the knowledge management framework.

3.2 Research approach and methods

A case study approach along with different methods and data sources were used partly in the current action, research and analysis. An extensive review of empirical literature has provided important insights regarding perspectives on the changing roles of HLIs in developing countries and good practices in realigning them. The latter was particularly

7. According to Davis et al. (2007), there were about 246 local and 122 international NGOs in Ethiopia and most of them were involved in agriculture and rural development.

useful to learn about possible options and opportunities to deal with similar challenges in transforming Ethiopian HLIs into *'developmental institutions'*. A review of secondary data sources, limited similar studies in Ethiopia, was done to fill gaps in the current dataset as well as for the validation or triangulation of the survey data.

Senior IPMS staff at headquarters served as key informants. IPMS is a development project, which ILRI has been implementing since 2004/05 with funding from the Canadian International Development Agency (CIDA). The project was initiated to support and strengthen the effort of the GoE in facilitating market-oriented and knowledge-based development of smallholder agriculture. This was planned to be achieved through the implementation of four interrelated project components: participatory commodity development, agricultural knowledge systems development, innovation capacity building, and promotion of evidence-based technological, institutional and policy options and approaches (Annex 2). The project uses participatory value chain development approach with innovation systems perspective; and it has been operational in 10 districts or Pilot Learning '*Woredas'* (PLWs) from Amhara, Oromia, Southern (SNNP) and Tigray Regions. IPMS being research-cum-development project, undertaking research has been a core project activity; and one of its important research modality is the use of graduate students. The senior project staff members have several years of experience in teaching and guiding graduate students and have served as members of boards of examiners who evaluated the quality of theses preparation and open defense. As key informants, the project staff provided important information on the basis of their observations engagement about the constraints and challenges to relevance and quality assurance in graduate research process.

The third source of data was a workshop, which was convened by IPMS in collaboration with Hawassa University (23–24 October 2008) to stimulate discussions by stakeholders about the quality and relevance of research by graduate students and to deliberate upon the way ahead. The participants (65 persons) were from the relevant federal ministries Ministry of Agriculture and Rural Development (MoARD)[8] and Ministry of Education, Ethiopian Institute of Agricultural Research (EIAR) and Regional Agricultural Research Institutes (RARIs), CGIAR centres (ILRI and IFPRI), and officials and deans of GPs from Addis Ababa, Haramaya, Hawassa and Mekele universities. The workshop process culminated with collective observations and consensus on key constraints, challenges and opportunities to ensure relevance and quality in graduate research.

8. MoARD is the previous official name of the current Ministry of Agriculture.

Fourthly, a survey was conducted in 2009 employing semi-structured questionnaire to gather two sets of data from the former IPMS graduate fellows:

i. Perceptions and observations regarding the status of the GPs in respective HLIs: infrastructure, facilities and services; learning experiences (curricula, mode of delivery, pedagogical approaches); and adequacy and capacity of staff and the quality of thesis research supervision.
ii. Perceptions and observations regarding field research and learning experiences whilst with IPMS.

Semi-structured questionnaire was employed to collect perceptions of the respondents, along with open-ended questions designed to encourage and elicit personal reflections on perceived key constraints, challenges and opportunities. The instrument was sent via e-mail only to those former IPMS graduate fellows who, at the time of the survey, had rejoined and served organizations for a while after obtaining their second degrees. About half (19 graduates) of them returned completed questionnaires. The low response rate could be due to incorrect or change of the addresses of some of the graduates.

The qualitative data were systematically categorized, tabulated and summarized. Simple frequency tables and bar charts were used to summarize the quantitative perception data from the tracer survey. Although the tracer survey data are indicative, additional information from earlier studies as well as data obtained from independent sources using different methods have been used for validation and triangulation purposes.

4 Status of the GPs in agriculture and related disciplines

Ethiopia has over three decades of experience with GPs in agriculture. The pioneer, then Alemaya College of Agriculture, launched GPs in 1979 at MSc level in five areas of specializations. Today GPs are being run by the Colleges of Agriculture of Haramaya, Hawassa and Jima universities, Wondogenet College of Forestry and the Faculty of Dryland Agriculture and Natural Resources of Mekele University and the Faculty of Veterinary Medicine of Addis Ababa University. About 29 new MSc programs in agriculture had been launched until 2007 and Haramaya University for the first time launched four PhD programs in agricultural disciplines (Belay 2007). The unprecedented political commitment of the GoE in supporting the expansion of HLIs, including GPs, is highly commendable. Nonetheless, the real challenge lies in transforming the GPs into responsive and vibrant centres of knowledge and innovation. This section discusses key indicators of relevance and quality of learning and research in GPs. The survey results reported here are indicative, not conclusive, of the situation of the relevant GPs covered in the current study. However, the survey data has been supplemented with and triangulated against available empirical evidence and data obtained from different sources.

4.1 Curricula and delivery methods in the GPs

Figure 1 displays summary of perceptions of the respondents, former IPMS graduate fellows, about the curricula in their respective universities. The relevance of course contents was rated by 61% of the respondents as very good or good. Yet local orientation of the curricula is not very strong. Little more than half of the respondents (55%) perceived the extent of contextualization of the contents as very good or good. About 83% of the graduates considered the relevance of their learning experiences to skills demanded at workplace as very good or good. The focus of curricula and learning experience on developing analytical and critical thinking skills was rated as very good and as good, respectively, by about 28% and 50% of the respondents.

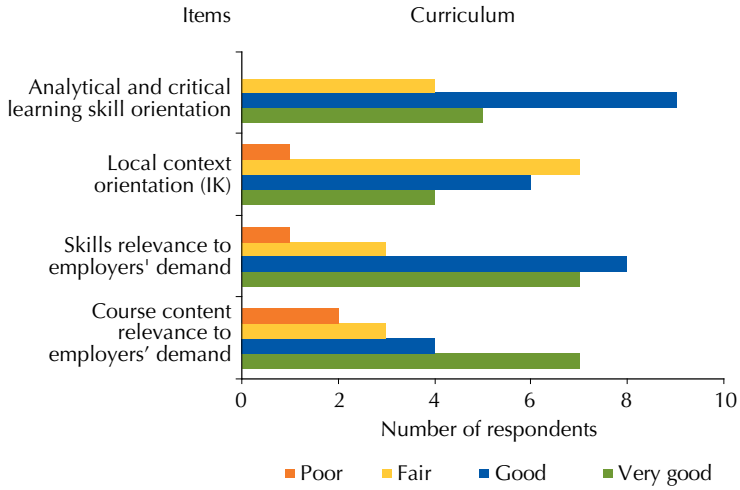

Figure 1. *Perceptions about curriculum.*

To supplement and triangulate the perception rating results, the respondents were given the opportunity to suggest any change or improvement that they perceived important with regard to curricula, delivery methods and approaches to teaching and learning. In general, the results indicate that the relevance of the curricula as perceived by the former learners is reasonably good. However, the respondents identified areas where further improvements are needed.

Accordingly, more than half of the respondents underlined the need for updating the curricula for GPs continuously in line with changing national policy, global trend, and thinking and practice in agriculture and rural development. They suggested also that revision of curricula be done with active participation of the key stakeholders. A number of specific changes in terms of addition and elimination of courses were suggested. Some of the suggested changes were specialization specific such as the addition of courses like innovation systems and technology assessment skills (rural development and agricultural extension graduates), institutional economics (economics/agricultural economics graduates) and more focus on operation and action research (animal sciences or production graduates). The other changes suggested by the respondents were crosscutting such as more research methodology course which covers data analysis and the application of statistical packages.

Perhaps the most serious concerns expressed by the majority were about delivery methods, overall approach to teaching and learning, and practical orientation of the curricula (Figure 2). According to the respondents, GPs instructors rarely used relevant practical examples, local case studies and often did not facilitate experience

sharing among graduate students. The teaching methods used by their instructors were conventional and often limited to power point presentations and some laboratory-based practical. Similarly, a study by Davis et al. (2007) showed that the common AET teaching methods in Ethiopia were often limited to lecture and technical/laboratory training using textbooks/handouts, LCD/overhead projectors and laboratory equipment as teaching aids.

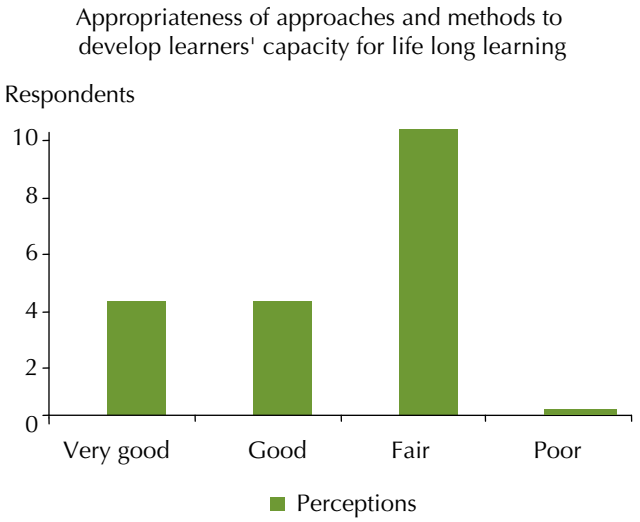

Figure 2. *Perceptions about suitability of the learning approaches.*

Secondly, most of the respondents indicated that practical component of the curricula in GPs was very poor and that they had rare opportunity for hands-on practical training and exposure to field realities whilst on campus. One of the respondents expressed his experience in his own words as follows; '*I cannot milk a cow properly either using my hand or machine though I have an MSc in animal production*.' The respondents were of the opinion that the curricula for graduate studies needed revision to create more space for practical training and experiential learning.

In addition, the respondents suggested the inclusion of practical sessions in research methodology (focusing more on operation and action research) and software application for data analysis and creating opportunities for exposure to real life situation through regular 'model small farm' visits, attachment/internship and community-based action research. In the same line, UNU (2009) recommended the adoption by African GPs of new and multi-method approaches to learning, encompassing social learning, service learning and field-based learning to cultivate the learners' practical, problem-solving and participatory decision-making skills.

Curricula and delivery methods are critical factors in ensuring responsiveness of GPs. Curricula for GPs should be firmly grounded in national development realities, sustained by contextualized research and committed to meeting societal needs (UNU 2009). Appropriate curricula design and review calls for research-based evidence and consultative processes involving key stakeholders. The involvement of key stakeholders is of paramount importance not only to articulate priority areas where skilled human resource is needed, but also to collectively design innovative mode of delivery that best address well articulated needs. Studies in Ethiopia, however, show that programs and curricula revisions in many HLIs were often carried out without the involvement of key stakeholders (Belay 2007), particularly from the private and NGO sectors, and without rigorous market research and tracer studies (Davis et al. 2007). More often, the contents are production/technology-oriented, emphasizing theoretical and conceptual issues to the detriment of practical skills and the development of learners' ability for lifelong learning.

Given the expanding agricultural knowledge-base, increasingly short knowledge cycle and dynamic context for development of agriculture and rural sector, GPs should focus more on cultivating learning aptitude and capability for lifelong learning (Teferra 2007). Cultivating capability for lifelong learning, in turn, requires active participation of learners in activities where both explicit and tacit know-how are shared, exchanged and created (Juma and Yee-Cheong 2005). This together with the need to ensure that learners are well acquainted with the real challenges facing farms, firms and communities, and become sensitive to social needs places high premium on practical exposure and experiential learning. In this regard, the gaps that currently exist in HLIs have far reaching implications. For instance, a study by Mashila (2005, cited in Belay 2007) reported that Ethiopian agricultural HLIs were producing graduates with less exposure to objective realities and less understanding of the challenges in agriculture and rural development. Similarly, Davis et al. (2007) reported that Ethiopian AET system was producing impractical graduates who had limited capability to participate meaningfully in the country's changing agricultural sector. Apparently such graduates could not stand the market test of employability, and the gaps will become a serious societal concern as public sector employment is fast approaching the saturation point.

4.2 Infrastructure and facilities and services

The availability, quality and easiness of access to infrastructure, facilities and services have a direct influence on the quality of learning and research in GPs. Unless carefully planned and phased, the rapid increase in enrolments in HLIs can create pressure and limit access to facilities and services like laboratories, ICT, library and reference materials.

Figure 3 shows the assessments by the respondents of the library services, availability and adequacy of relevant and up-to-date reference materials and access to ICT services (computer, e-mail and internet) during their study periods. About 56% of the respondents rated the access they had to computers and internet as good, whereas library services and access to relevant reference materials was rated by most of them as fair or poor. In particular, the issue of improving availability of relevant and up-to-date reference materials was underlined by the majority of the respondents. Frequent power interruption, unsuitable classrooms, in some HLIs, and inadequate accommodation and catering services were the other constraints mentioned by some of the respondents. Despite continuous efforts aimed at improving the infrastructure, facilities and services, the HLIs could not appropriately accommodate the needs of students whose population has been growing rapidly (see Belay 2007).

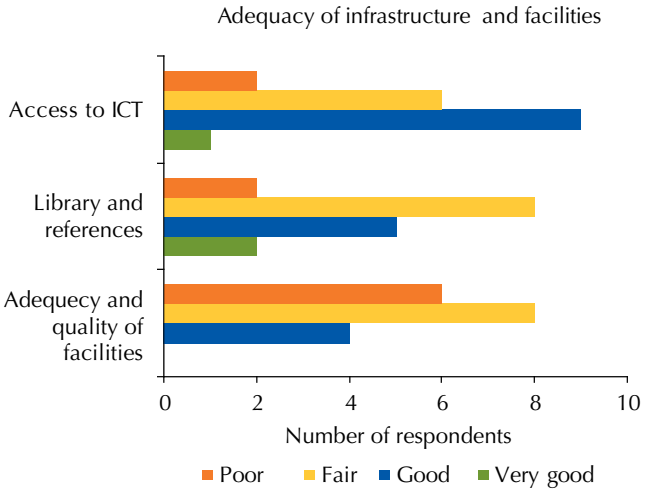

Figure 3. *Access to facilities and services.*

4.3 Adequacy and quality of staff in the GPs

The rapid increase in enrolments in HLIs beyond capacity set against chronic shortage of qualified and experienced staff would undoubtedly compromise the quality of education at both undergraduate and graduate levels. As the figure in Text box 1 shows, only 1004 (about 6%) out of 17,064 instructors in Ethiopian universities are PhD holders, most of whom are often office bearers with administrative responsibilities. Currently, HLIs in the country rely heavily on expatriate staff to fill the gaps. According to the Ministry of Education (2005, cited in Belay 2007), expatriates accounted for 74.4% of professors, 28% of associated professors and 26.6% of assistant professors in the country's

universities. Whilst the use of expatriates is useful for experience sharing and cross fertilization of ideas, high reliance at senior positions on expatriate academic staff who may have limited knowledge of national or regional challenges and institutional context can have negative repercussions on relevance and quality of learning and research in GPs.

Box 1. Dramatic increase in enrolments in Ethiopian universities

Weekly English Newspaper, Capital: vol. 12, no. 603, July 4, p 8 (2010)

According to government report, student enrolment in Ethiopia grew by almost 137% in the last five years, which was significantly higher than the growth in availability of teaching staff during the same period. Government institutions have enrolled, this year, about 185,788 students working toward degrees. Almost half of university degree students, currently deployed at several government universities, are getting their education from teachers with a Bachelors degree, according to a new government report. As the students have increased, so have the teachers; the numbers of university instructors have skyrocketed to 17,064. However, only 11,238 are currently teaching, while others are pursuing their education. Out of this half or around 5700 of teachers only have first degrees in their respective fields; and masters degrees are held by 4528, and 1004 have PhD. The Ministry of Education says, 'it strives to promote good quality higher education that is relevant with a focus on research and development'.

In addition to the regular programs, often the same staff members with more or less the same facilities are involved in many other parallel programs, including evening, summer, in-service and distance programs at both undergraduate and graduate levels. Expansion of parallel programs under critical staff shortage and high staff turnover has obvious negative repercussions on faculty time allocation for research, teaching and guiding students. In Davis et al. (2007) study, it was argued that the excessive focus by the GoE on higher education expansion or 'massification', as some would call it, was implemented at the expense of enhancing innovative capabilities of learners. Maintaining the quality of higher education in the face of rapid expansion is a challenge, which is getting increased policy attention.

The result of the assessment of staff situation in GPs on the basis of the perceptions of the respondents is as depicted in Figure 4. Here also the most critical problem seems to be ensuring the availability of sufficient number of senior staff for teaching and guiding graduate students. As normally expected, staff research and analytical skills were

appreciated by the graduates and rated by more than 83% of them as very good or good. Yet the result indicates that instructors' knowledge of latest development and options in agriculture, rural development and related fields needs some improvement as only about 39% of the respondents perceived it as very good.

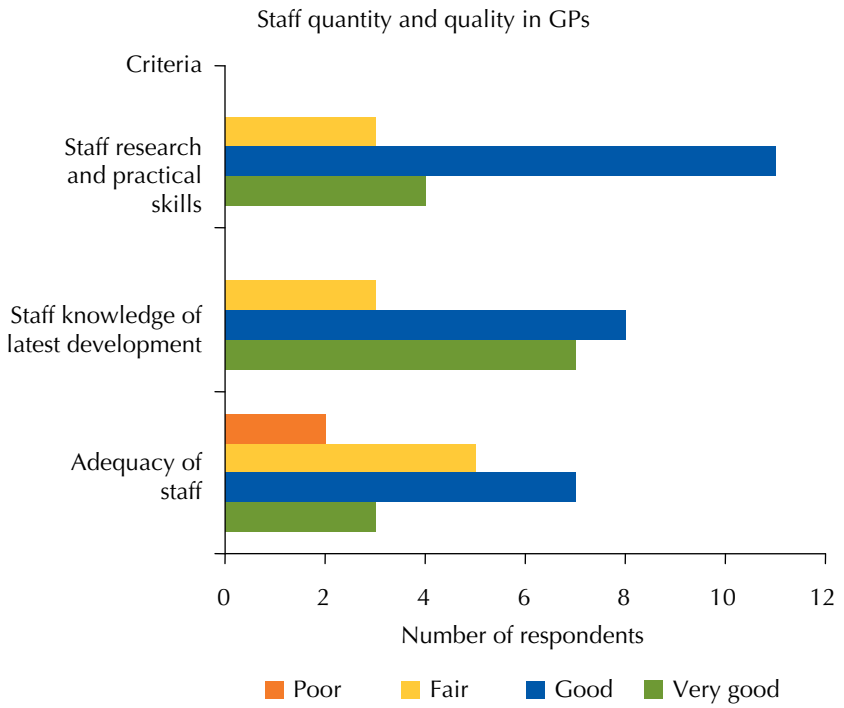

Figure 4. *Perceptions about staff situation in GPs.*

The suggestions made by the respondents regarding the assignment of instructors for GPs include: assigning experienced instructors for research method courses; considering capability and experience in teaching at graduate level (not just PhD holders) while inviting guest instructors; developing mechanisms to ensure that instructors are well prepared and use variety of teaching and assessment methods; creating a mechanism for assessing the quality of supervision; and focusing only on regular GPs to improve and maintain quality of education in GPs. Whether the latter is feasible politically (commitment of the GoE to rapid expansion of access to higher education), acceptable to universities economically (need for generating internal revenue) and to staff (high need for supplementing low salary) is doubtful. Although university instructors in the poorest countries are generally poorly paid, the payment (annual base salary plus benefits) in countries like Mozambique, with more or less similar economic condition with that of Ethiopia, was higher by threefold (Davis et al. 2007).

4.4 Graduate thesis research supervision and relevance

In the tracer study questionnaires, the graduates were asked to rate adequacy of guidance by university supervisors in general (not necessarily their own supervisors) under laboratory and field conditions as well as whether the supervisors provided students with timely and critical feedback during thesis research. As shown in Figure 5, less than half (about 44%) of the respondents agreed that the adequacy and quality of supervision was good, whereas about 33% of them rated the same as fair. Nonetheless, perception is always subjective, which is based on the level of knowledge and experience of individuals. Hence, to supplement and triangulate the perception data, the respondents were also asked their opinions about the extent of relevance and quality of theses in general and to make suggestions for improvements, if any. The opinions of the respondents with respect to relevance and quality of graduate research projects were expressed using words/phrases like 'repetitive', 'irrelevant topic', 'less focus on real problems of smallholder farmers', 'donor-driven', 'instructor-driven', of 'questionable quality' etc. A closer look into the opinions seems to suggest that a larger proportion of graduate theses were repetitive, less focused on the real problems of the farming community, and often done technically poorly.

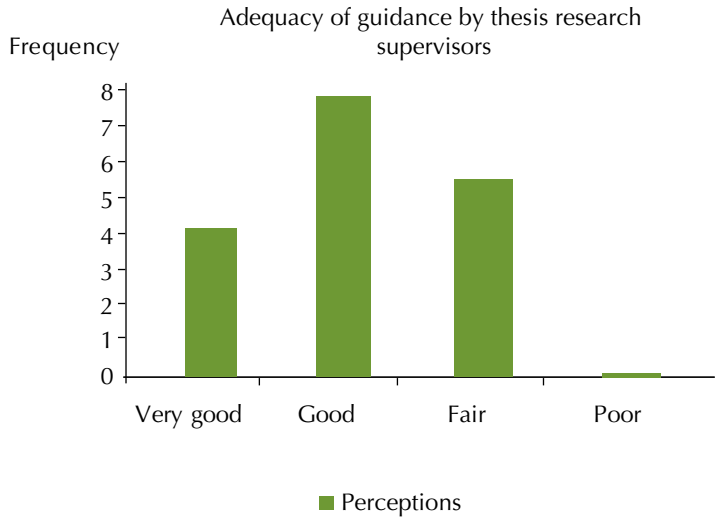

Figure 5. *Perceptions about adequacy and quality of thesis supervision.*

The main reasons identified by the respondents for the lack of relevance of topics for theses research projects and often poor quality outputs were: students selected topics without adequate exposure to field reality and adequate understanding of the real

problems of the communities, farms and firms; poor linkages between GPs, employers and funding organization; difficulty of accessing fund for sound proposals; limitation in the quality of guidance partly due to increasing number of advisees that an advisor had to handle at a time; and lack of expertise support (like a research methodology group) in research design and the application of data analysis software. In addition, limited support from faculty in identifying topical issues was mentioned. Apparently, staff members in the GPs have limited time, unclear mandate, limited resource and little incentive to engage meaningfully in development oriented research. A study also shows that often the instructors could not attend international events and other knowledge sharing opportunities due to limited access to funding for such purposes (Davis et al. 2007). The limited engagement of faculty in development-oriented research and their limited international interaction to stay current in their areas of specialization has direct and indirect negative influence on their ability to provide quality guidance and to ensure utility of research outputs.

Furthermore, Table 1 shows the summary of observations made by the IPMS project staff with regard to the relevance and quality of theses by graduate students. The observations of project staff are not as such different from the views of the former learners, except for providing detailed information.

Table 1. *Summary of observations by IPMS staff about graduate research relevance and quality of graduate theses*

Critical stages in thesis research	Observed limitations
Concept note and proposal development stage	Proposals are often ill-conceived, production-oriented, with little practical relevance Poor interaction between students, supervisors and sponsors Students lack support from statisticians; hence poorly designed research
Implementation stage	Students lack practical skills (field and laboratory) and experience in working with communities Inadequate field supervision by university supervisors—due to heavy coursework load and many advisees that an instructor guides at a time Some of the supervisors fail to provide timely and critical feedback
Write-up stage	Limited ability of students in critical and systematized use of the literature Limited skills of students in scientific writing Often students lack skills to draw appropriate conclusions and to forward concrete and practical recommendations
Documentation and sharing of knowledge	Thesis (hard/soft copy) documentation by graduate schools is a common practice; and in few cases, some universities publish theses abstracts However, research outputs only reach limited number of professionals and too technical, excluding their value to the wider non-scientific community—who are often the intended end users

Likewise, the stakeholder workshop participants confirmed the observations made by the IPMS project staff (Table 1) and generated additional insights (Table 2). As observed by the stakeholders, most of the relevant HLIs did not have clearly defined and shared research thrust and institution-wide and/or program level research priorities. Under such circumstances, it is very likely that research topics would be selected by the faculty and graduate students on the basis of personal academic interests, research conducted by the faculty members and students de-linked and the faculty and students would tend to respond to all sorts of incidental requests from projects, NGOs etc. This kind of approach to research in GPs, however, is unsuitable for systematic accumulation of knowledge, enhancement of innovation capabilities of research teams and for building institutional comparative advantages in the long term (Daane 2009). Experiences elsewhere, on the other hand, show that the existence of a long term strategic research plan in clearly defined thematic areas could enable HLIs/GPs to achieve their long run research objectives through series of MSc/PhD research projects (UNDP 2010) with quality guidance. As suggested earlier by the graduates who took part in the survey, facilitating staff active involvement in identifying new and relevant research areas by engaging employers and other stakeholders would be of paramount importance and a critical step towards formulating institution-wide strategic research plan and program level research priorities.

Table 2. *Summary of observations of stakeholder meeting about the status of graduate research*

Relevance and quality	Funding and staff	Documentation and dissemination	Weak linkages and collaboration
Questionable quality of research	Near exclusive reliance on limited government funding	Poor documentation	Intra-institutions
Generally driven by individual interest	Disparity in allocation of funds—uncoordinated	Dissemination mostly in the peer community	Inter-institutions
Haphazard, isolated, supply-driven, technology-focused	Problem of availability of adequate staff	Inadequate use of ICT	Research–extension–education
Mismatch with duration of research demand and available student time	Senior staff retention problem	Poor writing and communication skills of students	Other relevant actors (private sector, farmers, NGOs etc.)
Lack of a coordinated national agricultural research plan	Limited flexibility of staff to adapt and respond to changing demand and expectations		Weakening integration between research and higher learning institutions

Assessment and evidence presented in this section suggest that there are important gaps in the relevance and quality of research and learning in the GPs. This is due to, among other things, the poor linkages of GPs with economic and social sectors and limited

interaction of the faculty with national and international R&D actors. Further, as also shown by a similar study (Belay 2007) factors such as unclear research and development mandates of HLIs, lack of national/institutional strategic research plan and program level research priorities, limited funding for research and outreach activities of HLIs, increasing teaching load of staff with enrolment and insufficient incentive constrained meaningful engagement of the GPs in development-oriented research. With respect to teaching and learning in the GPs, the prevailing philosophy and approaches are less appropriate to cultivating capacity of learners for lifelong learning. The dominant method of delivery remains top–down and lecture- and laboratory-based. Inadequate opportunities for experiential learning and gaps in facilities and reference materials of relevance to changing context for the development of Ethiopian agriculture and rural sector are important factors constraining teaching, learning and research in the GPs.

5 IPMS experience with graduate programs in enhancing research relevance

IPMS has been working since its inception closely with national HLIs relevant to agricultural sector, particularly in building capacity of staff from partner public organizations through training at first degree and masters levels. IPMS has, over the past five years, fully financed several candidates who were nominated by the public research and extension organizations. In addition, many other graduate students, including those from NGOs, with good academic performance received support to undertake research in areas relevant to IPMS priorities. In total, 60 IPMS-sponsored graduate students (tuition/thesis or thesis only) had successfully defended their theses and another 40 were at various stages in their research at the time of the survey. This section presents IPMS experience in linking GPs through the research projects it supported to commodity development activities and value chain actors to draw out some lessons. The section discusses the approach and *modus operandi* employed and reports on learning and research outcome indicators on the basis of qualitative and quantitative data from the tracer survey.

5.1 Processes and mechanisms

IPMS strategies and modalities to enhance the relevance of graduate research to commodity value chain development were aligned with critical stages in the graduate research process. In particular, due attention was given to proper problem identification, enhancing skills to conduct rigorous analysis and develop appropriate recommendations, and to the facilitation of knowledge sharing and dissemination of research outputs.

5.1.1 Problem identification and proposal development

At project level, the problem identification process with partners involved the use of secondary data, GIS, expert consultation, and participatory diagnostic survey (PRA) and work plan development for each PLW. Subsequently, a workshop was organized and brought together stakeholders encompassing agricultural extension, research, service providers, administration, women and men farmers, processors, traders and exporters. The stakeholder workshop was needed to agree on priority commodities, problems, possible solutions, and responsible organizations. Problems which had readymade solutions were dealt with the experts and the research institutions. Researchable issues were identified in areas where there were knowledge gaps.

IPMS facilitated students' consultation with partners and stakeholders. The graduate fellows identified researchable problems and developed concept papers in consultation with IPMS staff and partners at the PLWs (Table 3). IPMS staff communicated during full proposal development with the graduate fellows and, to the extent possible, with university supervisors. This helped to steer research by the students to priority researchable problems that had been identified during the diagnostic survey and work plan development as well as to studies which would be conducted with the view of developing specific intervention options or solving emerging problems along specific commodity vale chains.

Table 3. *Topic identification process for thesis research (19 respondents)*

Topic selection process	Responses*	Percentage
Suggestion of IPMS HQ staff	11	57.9
Consultation with IPMS PLW staff	6	31.6
Literature review	10	52.6
IPMS document review	10	52.6
Prior student experience	10	52.6
University supervisor suggestion	5	26.3
Suggestion of employers (ARARI)	1	5.3
Suggestion of farmers	1	5.3
Presented proposal at WALC	6	31.6

*Due to multiple response options, responses are greater than the total number of respondents in this and the other tables.

In addition, IPMS facilitated the establishment of *Woreda* Advisory and Learning Committee[9] (WALC). WALC serves as important platform for graduate students to present research proposals for feedback before the actual implementation commences. As shown in Table 3, only a third of former graduate fellows covered by the tracer survey used the opportunity of presenting proposals at WALC to solicit comments. Proposal defense at WALC was not made compulsory and the project did not proactively orient the fellows about the importance of interaction with such a platform to ensure relevance and a focus on problem-solving research.

5.1.2 Research implementation and write-up

The project provided technical assistance to the graduate students by assigning its senior staff members as co-supervisors to ensure effective implementation and quality of theses. In addition, a training workshop involving university supervisors was carried out on 'the

9. WALC is a structural arrangement for coordinating multi-stakeholder (public, cooperatives, rural finance, NGO and limited private actors) pilot intervention planning, process monitoring, and learning.

application of innovation system concepts and approaches in agricultural research for development (AR4D)' to strengthen graduate research supervision. To enhance research skills of the graduate fellows, IPMS in collaboration with the Capacity Strengthening Unit (CaSt) of ILRI conducted specialized trainings such as research methodology, proposal writing, statistical analysis, scientific presentation techniques. Further, IPMS supported some of the graduate fellows to participate at relevant national conferences, workshops and seminars.

WALC served as an important platform for graduate students to present their research findings to relevant development actors and potential users for verification, validation, and also for sharing knowledge generated through graduate research. Accordingly, the graduate students conducted seminars and shared their research findings with experts, DAs and, in some cases, communities they worked with, whilst in the respective PLWs (Table 4). Short presentations on community mobilization forum, training workshop and at technology exhibition were the other mechanisms used to share main research findings/recommendations.

Table 4. *Sharing of research findings before thesis defense (17 respondents)*

Who did you share with	Responses	Percentage
Experts	11	64.7
IPMS	10	58.8
DAs	8	47.1
Community	9	52.9
Researchers	5	54.4
NGO staff	1	5.9
ATVET instructors	1	5.9

5.2 Intervention output and outcome indicators

As explained in the preceding subsections, graduate research projects were steered to priority and relevant topics and were systematically aligned to a broader development framework—commodity value chains and innovation systems. The latter was achieved by linking graduate research to commodity value chain development through research formulation, implementation and sharing of findings before the completion of the write-up. The students were exposed to new research and development concepts. It was expected that IPMS graduate fellows would benefit from the exposure to development interventions and from the opportunity to interact with communities and various commodity and R&D actors. However, tracer study is often recommended to trace and document the extent to which such an intervention has made some influence through

training outputs and outcomes (IFPRI 2009). This subsection presents and discusses the survey data on the intervention output and outcome indicators in terms of enhanced learning experience, research relevance and output utilization.

5.2.1 Learning experiences during research and field exposure

Relevant and effective human capability and competence building from an innovation systems perspective requires interactive process involving learning-by-using, learning-by-doing or learning-by-sharing (Hidalgo and Albors 2008). Thus a range of knowledge interactions are crucial (UNCTAD 2010). With respect to this, linking HLIs to development through graduate research could benefit not only graduate students, but also farmers, development agents and experts. As summarized in Table 5, farmers and DAs had received training and/or some advice from the students, informally though it might be. Some of the experts also got technical assistance and benefited as well from the learners' computer application skills.

Table 5. *Involvement of IPMS fellows in development activities during PLW stay (19 respondents)*

Involvement in development/capacity development activities	Responses	Percentage
Training or advising DAs and/or farmers	13	68.4
Assisted in organizing and/or conducting learning events	9	50
Assisted experts in computer application	7	36.8
Assisted in data collection/analysis	7	36.8
Assisted in preparation of communication materials	3	15.8
Suggested/introduced new technical options	8	42
Introduced participatory methods	11	57.9
Facilitated knowledge (3) market (1) and service (1) linkages	5	26.3

The benefits to the students of the linkages with farming community, value chain actors and supportive services were enormous in terms of knowledge sharing, and practical and soft skills development. The survey result suggests that the graduates during their fieldwork and their stay in respective PLWs had a lot of opportunities for interaction and experiential learning (Table 6). The respondents indicated that the experience had helped them to have a better understanding of and an appreciation for IK such as in dairy (calf management, health care, processing and butter quality standard determination), poultry (disease control), horticulture (banana ripening method) and irrigation (water management, irrigated rice production). In addition, their exposure to real life situations had helped the graduates to better understand the complexity and diversity of the production and marketing systems, farmers' decision logic and criteria such as in

improved variety selection, participation in marketable commodity production etc. For instance, a couple of graduates indicated that they had learnt that food security status of households determine, among other factors, the likelihood of participation by households in marketable commodity production. As a result, specialization and diversification was occurring in villages side by side.

Further, some of the respondents indicated that they were able to observe, for the first time, some improved technologies, practices and/or applications, encompassing onion seeds and tomato seeds production, milk quality testing equipment and use, modern livestock feed and milk processing, integration and application of Indigenous Technology and Knowledge (ITK) and improved practices in apiculture etc. Through field research and interaction, they were able to learn and appreciate challenges relating to marketing, service delivery, extension, linkages and coordination; and inability of female farmers to benefit from extension, services, and their high reliance on informal network to access knowledge and resources. Moreover, based on their own first-hand experiences, the graduates were able to identify capacity development needs, needs for technologies and improved practices, and what they thought good practices and opportunities to address constraints to smallholder commercialization. These are summarized in Table 6.

5.2.2 Learning outcomes

Knowledge, skills and behavioural changes are the critical outcomes of any successful effort geared towards building capabilities and developing competences of individuals. Sets of key indicators (Sloman 2004) were included in the instrument employed for the tracer survey to elicit perceptions of the former IPMS fellows on key learning outcomes. This part of the questionnaire was completed by 18 respondents. The results from the survey have been summarized and are displayed in Figures 6, 7 and 8.

Table 6. *Summary of IPMS fellows' observations during PLW stay through exposure and interactions*

Category	Description
Capacity development needs	Milk quality and safety, improved crop protection and post-harvest practices Marketing extension for DAs and business skills for farmers Management and leadership for cooperative Construction and use of water harvesting structure
Needs for improved technology or practice	Improved crop protection and post-harvest technologies to reduce loss Affordable water lifting equipment in water harvesting Research for 'local' rice variety improvements as the market prefers local to recently introduced varieties Stimulating private supply of seeds and crop protection service
Challenges to smallholder commercialization	Food insecurity, risk, high post-harvest losses and limited marketable surplus Limited bargaining power of farmers and high influence of brokers and buyers, particularly in vegetable commodities Lack of quality and standard, and in some cases limited access to market and market information
Limitations of public extension	Lack of capacity and professionalism to facilitate smallholder commercialization Weak marketing extension service, limited attention to post-harvest technology and value addition Top–down and biased in favour of progressive farmers, external knowledge and cereal crops at the expense of poor and women farmers, ITK, and livestock, particularly poultry
Input supply and supportive services	Public sector dominated, limited capacity, particularly to meet service demand for livestock Limited livestock credit and virtual absence of insurance for risk mitigation both for crop and livestock No small business development service
Linkages and coordination challenges	Weak linkages and coordination even among public actors due to role ambiguity and difference in interests and objectives which led to duplication, inefficiency (e.g. in small-scale irrigation development), and in certain instances outright conflict
Knowledge management (good practice)	Different methods for marketing information dissemination being introduced Knowledge management at different levels and existence of structures like WALC for coordination Information exchange mechanisms such as weekly group knowledge sharing exercise, field-day, experience sharing visits, visit to farms of innovative farmers, demonstration at FTC etc.
What worked (good practice)	Community-based seed system and farmer-to-farmer seed exchange Horticultural crop production is expanding rapidly Some dairy cooperatives are playing important role in facilitating knowledge, service and market linkages for members Satellite milk collection centres to link dairy farmers in peri-urban areas and increase the supply of milk for processing Synchronizing cattle fattening with holidays
What did not work	Group lending approach unpopular Very limited adoption of livestock technologies, improved feeds and breeds

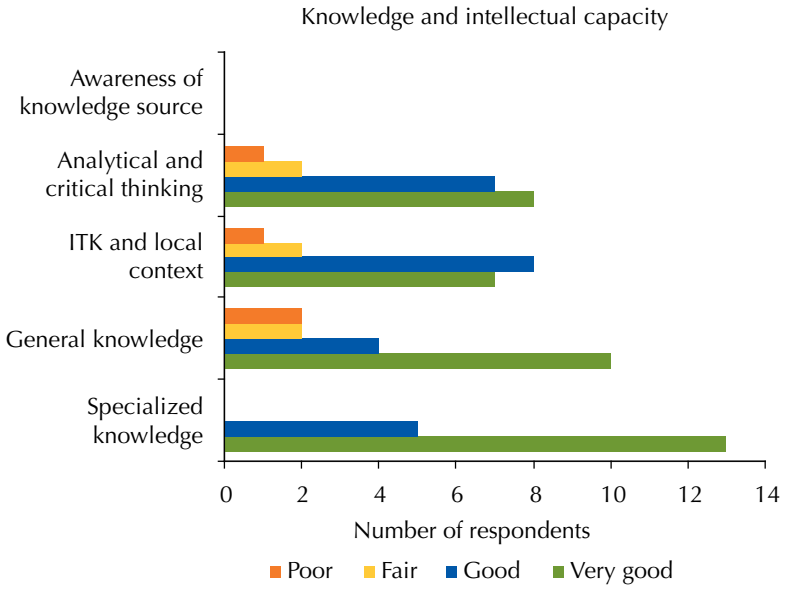

Figure 6. *Perceptions on knowledge and intellectual capacity outcomes.*

Figure 6 shows the respondents' perceptions of the impact of the learning experience in terms of knowledge and intellectual capacity indicators. The role of the learning experience in enhancing specialized knowledge was rated by 72.2% of the respondents as very good and rated as good by the remaining ones. More number of respondents perceived that the impact of the learning experience on their general knowledge and analytical skills was very good, whereas slightly more respondents perceived impact of the learning experience on their awareness of indigenous knowledge and local context as good. Overall, these results can be accepted as valid as they are in conformity with the qualitative analysis reported in the preceding subsection (5.2.1).

As expected, the field research and practical exposure has had a profound impact in enhancing practical competence and soft skills of the graduates (Figure 7). While slightly more respondents rated the experience as very good in terms of enhancing their communication skills, whereas the experience was considered as good by slightly more respondents and as very good/good by equal number of respondents in terms of enhancing competence in ICT and skills in participatory methods, respectively. In fact, the application of ICT, in particular the use of computers, data analysis software, and LCD and other materials for presentations were very much related to the actual research activities than field exposure, such as accessing literature on-line, application of software for data analysis and the thesis write-up and knowledge sharing. During their fellowship period the graduates had better access to internet at ILRI and could access computers and read e-mails in some of the PLWs at *Woreda* Knowledge Centres.

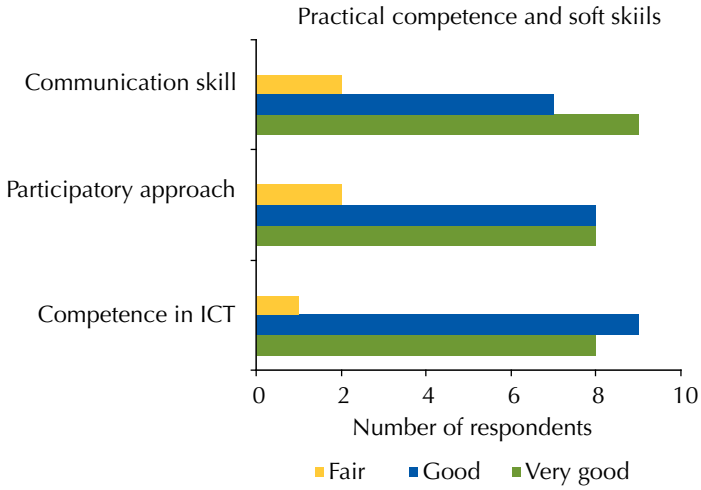

Figure 7. *Perceptions on practical competence and soft skills development outcomes.*

Building capacity for sustainable development through higher education should aim not only at imparting knowledge, but also changing the learners' mind-set and behaviour (UNU 2009). Achieving desirable change in learners' behaviour is perhaps the most important outcome that any capacity building initiative would look for. From the view of building capabilities for learning and innovation, behavioural competences such as cultivating learning aptitude as could be reflected in proactive information seeking, openness and receptivity to different or new ideas, and confidence in decision-making and challenging *status quo* based on evidence are important. Here again, the feedback in the form of perceptions of the former IPMS fellows is quite encouraging (Figure 8). The graduates (83.3%) rated their learning experience as very good in cultivating both information seeking behaviour and openness to changes and new ideas. Further, about 72.2% of the respondent found their experience very good in enhancing confidence.

5.2.3 Research output, sharing and utilization

In addition to producing graduates who are technically and practically competent, sensitive to social needs and have adequate understanding of national context and challenges in development; GPs are expected to contribute to solving practical problems and addressing challenges to smallholder transformation. This could be done by students and faculty in GPs, among others, by carrying out relevant research and promoting the utilization of outputs through proper documentation and effective communication. In the same line, IPMS encouraged the graduate fellows to share their research outputs through ILRI wide graduate seminars, and presentations on relevant, mainly national, forums. In addition, IPMS collaborated with CaSt in facilitating the launching of Graduate Fellow

Forum (GFF)—a platform for the graduates to share research results, interact and maintain contact with ILRI. Furthermore, the project carried out the documentation of theses and facilitated the publication and dissemination of selected practically useful graduate research outputs in the form of working papers.

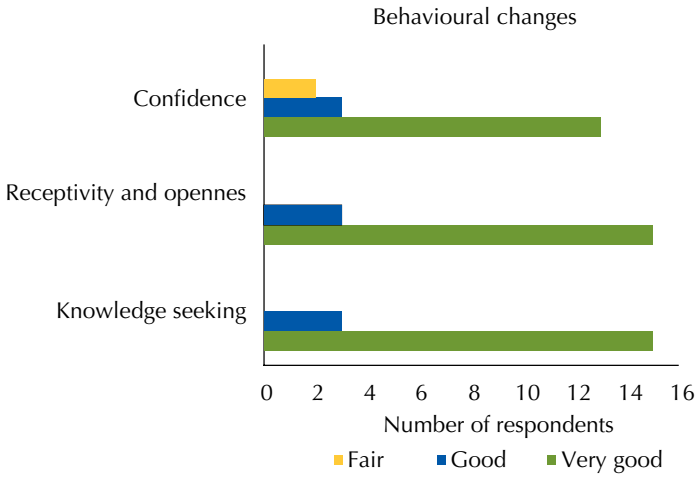

Figure 8. *Perceptions on behavioural change outcomes.*

As the tracer survey results reported in Table 7 clearly show, the respondents shared the findings and their recommendations after defense mainly through presentations at conferences and seminars and distribution of hard or soft copies of theses or summary of major findings and recommendations. Out of the 12 papers presented at conferences by the graduates, two-third (8) of the papers were already published in proceedings at the time of the survey. Two of the 17 graduates were able to publish articles they extracted from their theses in peer-reviewed journals. Moreover, four graduates were able to publish their research outputs as IPMS working paper series.

Table 7. *Sharing of research findings after defense (17 respondents)*

How did you share?	Responses	Percentage
Conference	12	70.6
Seminar	10	58.8
Distributed hardcopy	9	52.9
Distributed softcopy	5	54.4
Publications	Responses	Percentage
Conference proceedings	8	47.1
Working paper	4	23.5
Newsletter/bulletin	2	11.8
Peer-reviewed journal	2	11.8

Further, the research outputs the graduates have generated through their theses are important inputs to the overall endeavour of the IPMS project. In some cases a graduate fellow carried out a thesis research on the same topic such as assessment of the accessibility and effectiveness of public AI (artificial insemination) service in different PLWs or different graduate fellows carried out site specific research on similar topics such as assessment of the relevance and effectiveness of farmer training centres, using more or less similar research approach. The outputs are being synthesized to be used as input to the identification of institutional and organizational options to address crosscutting issues. In other cases, graduate fellows from different disciplines had independently conducted site specific research whereby different issues relating to specific commodity value chains were addressed, such as production technology, service delivery, postharvest, marketing. The synthesis of the latter outputs could generate important insights and inputs for cross sites comparative study of value chains. As indicated earlier, the project has been supporting and facilitating the conversion of selected theses into IPMS working paper series. This has been found useful to disseminate outputs of graduate research with practical utility. The working papers are being used in universities, contributing to addressing the scarcity of reference materials of relevance to Ethiopian agriculture.

Finally, there is some anecdotal evidence indicating that several of these 'new style' graduates are already playing important roles in different capacities influencing the direction of market-based smallholder agriculture development. Also, data from the tracer survey (Figure 9) provides a pointer in a similar direction. More than two-third of the respondents thought that they were empowered through enhanced capacity to make better contributions and to exert some positive influence in their organizations. By turning the question around and asking the respondents to provide concrete case/ personal story that made them feel more important and influential, we tried here again to verify the validity of their subjective perceptions.

The reasons behind their perceptions were different, and included: i) two respondents claimed that they were able to promote the uptake of some of improved practices recommended in their theses and/or their recommendations were used as inputs in planning interventions in non-research *woredas*; ii) one respondent claimed that he was able to promote knowledge management perspective and to stimulate value chain research in his institute; iii) a graduate indicated that his thesis was used in other *woredas* as an input into lessons learnt and planning exercise and by an NGO (Land O'Lakes) for training; iv) a graduate who was a support staff (planning, M&E) of a regional research institute indicated that he was able to participate in and contribute to agricultural research after graduation; and v) others simply said that the training enabled them for career development. The survey data on employment history before-and-after second

degree show that those graduates who said their enhanced capacity had helped them to make significant difference had indeed moved either to higher positions in the same public organizations or to better paying jobs in the NGO sector (Annexes 3 and 4).

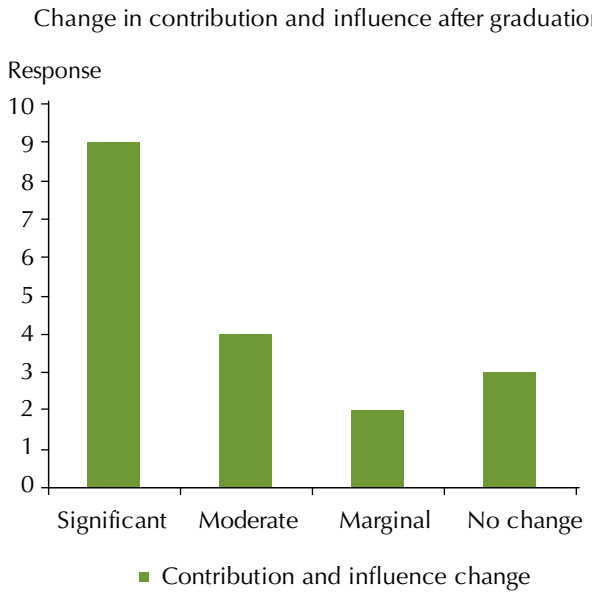

Figure 9. *Perceptions of graduates about their contribution and influence.*

5.3 Partnership for sustainability

The challenge with project approach is the issue of sustainability. Cognizant of this, IPMS convened a national stakeholder workshop in October 2008 with the purpose of stimulating higher level deliberation as to how to forge sustainable partnership to enhancing the relevance of graduate research in advancing agricultural sciences and development in Ethiopia. During the stakeholder workshop, the participants identified opportunities to improve research and learning in GPs (Table 8). The importance of having some kind of coordination mechanism and a platform were considered critical to translate the recommendations into concrete actions. Thus, it was agreed to establish a 'Forum for Graduate Research in Agriculture', FGRA for short. The forum is consisting of deans of schools of graduate studies of relevant higher institutes as well as representatives from the MoARD and EIAR. Actors like IPMS and the Rural Capacity Building Project (RCBP) of MoARD were identified as collaborators with important facilitation roles. It was also agreed that Hawassa University would play a coordination role during the transitional period.

Table 8. *Summary of stakeholder meeting recommendations towards strengthening graduate research*

Key issue	Key recommendations
Enhancing relevance	National research and development plan
	Thematic approach—most universities do not yet follow the thematic approach, but there are emerging cases
	Aligning organizational and individual interest—creativity
Improving funding and staffing situation	Industry/commercial clients linkages
	Donors/projects/NGOs as sources of funding
	Postgraduate grant schemes
	Staff and student incentive schemes
	Creative staffing arrangements (joint appointments, university/research/industry collaborations)
	Linkage and partnership with foreign universities
Documentation and dissemination of research outputs	A web-accessible theses database, to increase their potential application, and also discourage plagiarism
	Ethiopian Agricultural Portal, as a means for disseminating research outputs
	Repackaging research outputs
	Using research output for development of training materials
	Involvement of students in applying graduate research outputs
Partnership	Stakeholder forum
	National graduate council
	Theme based research and innovation partnerships

6 Conclusion and recommendations

Enhancing agricultural knowledge-base and capacity to access and productively use knowledge will be crucial for achieving productive, remunerative and sustainable smallholder agriculture in Ethiopia and beyond. For such knowledge and capacity development to be relevant to the Ethiopian development context, it is important for HLIs to be involved and aware of the development strategies and priorities of the GoE. As described in this paper, the government has recently developed a Growth and Transformation Plan as well as an Agricultural Sector Policy and Investment Framework. Both documents show a shift in emphasis from subsistence agriculture to a more commercial market-oriented development, which do require new knowledge and capacities. In facilitating this, GPs in agriculture and allied disciplines can play a vital role if realigned and strengthened in human and institutional capacity. The purpose of this paper was to make a modest contribution to the discourse on reforming HLIs and GPs to enhance their relevance to development. The authors hope to provoke, through this paper, further debate and to stimulate more systematic and analytically rigorous research.

The diagnosis of the status of the relevant GPs in Ethiopia highlighted constraints, challenges, and also opportunities to ensure responsiveness and quality. The focus on expanding and strengthening GPs in Ethiopia through increased public investment in infrastructure, facilities, and in recruiting staff and upgrading their qualifications is undoubtedly important. Yet, the priority should go beyond this, to focus on addressing other critical constraints and challenges that the GPs are grappling with. These encompass ensuring practical- and problem-solving—orientation of curricula and/or methods of delivery and availability and access to relevant and latest reference materials; addressing lack of clarity in research and development mandates of HLIs, the lack of shared institution-wide research thrust, program level priorities, limited resource and incentive for staff to engage meaningfully in development oriented research; and expanding the rare opportunities for interaction and staff participation at knowledge sharing events at subcontinental, continental and international levels. These challenges could not be solved by government or individual HLIs alone, but rather require linkages and collaborations with economic and social sectors and national and international R&D actors.

IPMS experience has been presented as a showcase regarding where and how a development project could contribute in linking GPs through research to development issues and actors. The experience offers an approach and *modus operandi* important to involve students in demand-driven research, knowledge sharing, development/

capacity development activities and practical learning in real-life settings. Experience demonstrated that research by graduate students could be made more relevant and problem-solving by involving employers and/or intended research output users, and by putting in place mechanism and process for facilitating research priority setting, implementation, knowledge sharing and quality supervision. The lessons imply, on one hand, that GPs should be proactive in creating partnership with regional and federal governments, actors, and with development/interventions. Public and non-public development actors who are truly committed to sustainability, on the other hand, should be more willing to integrate systematically into their development programs/projects, as a critical component, partnering with and strengthening capacity of key capacity building national institutions, such as the GPs in agriculture and allied disciplines.

IPMS had no direct influence, however, on the curricula of the GPs. The achievement in improving the quality of theses was limited. This was primarily due to insufficient skills of the graduate fellows to conduct development-oriented research as well as due to senior staff shortage set against increased enrolment in GPs for quality supervision. Some of the options to overcome the staff shortages may include: i) striking a balance between enrolment and capacity, particularly availability of senior staff; ii) exploring the possibility of integrating e-learning and teaching; iii) creating an enabling environment to facilitate 'brain circulation' to efficiently utilize domestic skilled and experienced professionals and to attract the Ethiopian diasporas; and iv) mobilizing the support of expatriates with UN agencies and the CGIAR centres based in Ethiopia and forging linkages to solicit the support of overseas voluntary associations.

The initiative to create functional multi-stakeholder platform, including at subnational levels, needs to be considered as it will be useful if cost effective. Nevertheless, the forum should be inclusive, with enough representation of producer organizations/ unions, business and agro-industry associations, NGOs, and alumni and professional associations. Such a platform can facilitate experience sharing on better ways of strengthening linkages between education, research, extension and development; setting national/subnational priority research agenda and thematic areas through participatory process; and for periodic deliberation on vision, strategies and action towards enhancing developmental relevance of GPs and informing public policy. Moreover, the platform might be useful to coordinate efforts in mobilizing resource and in lobbying for more public support to strengthen graduate research, whilst ensuring that the funding system will be based on the contribution to development that respective GPs are likely to make.

Although not explicitly addressed in this paper, another option that is worth considering is exploring opportunities and developing strategies to enhance linkages and

collaboration of GPs with governments and actors in the region (neighbouring regions) where the universities are situated (Annex 2). This is crucial within Ethiopian context due to: i) the wave of expansion with increasingly fair regional distribution of universities; and ii) the highly diverse production, rural livelihoods and food security systems, and environmental challenges across the regions. Nonetheless, the habits and practices of regional governments are such that they may not have felt needs for research-based knowledge and innovation. On the other side, the capacity and incentive structure within HLIs are such that GPs may be less responsive to regional priorities. Perhaps assessing existing capacities within the GPs may be an important entry point to design an appropriate capacity strengthening strategy. Further, establishing national competitive grants for universities' regional engagement and collaboration is an option worth considering. This can stimulate effective demand for research-based knowledge and innovation, while also creating incentives for response by universities and their graduate programs.

Finally, we would like to wind up with a caveat. As research and experiences elsewhere show, tackling one area without appropriate attention to inter-related aspects would lead to partial success. Hence, a holistic approach from an innovation systems perspective with long-term commitment has more chance to succeed. The authors are of the opinion that the strategies to realign and strengthen the graduate programs in agriculture and related disciplines entail: i) stimulating and ensuring effective demand from the bottom; ii) strengthening staff competencies and organizational response capacities within the university system; and iii) supporting the response from the top through appropriate policy, legislation, funding and incentive structure.

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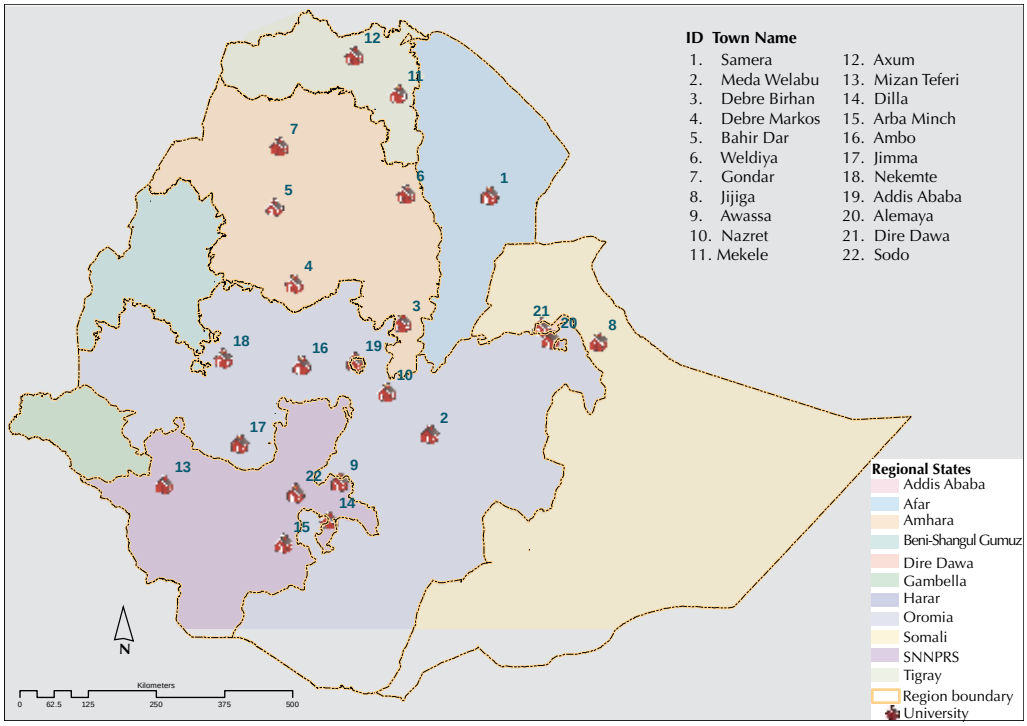
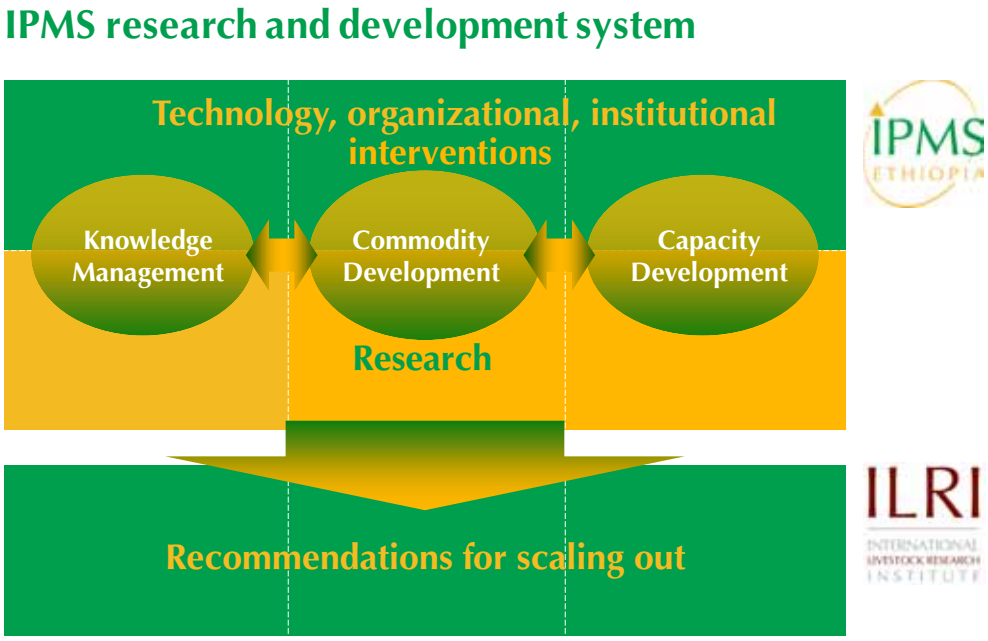
Annex 1 Regional distribution of universities in Ethiopia



Annex 2 IPMS project components



Annex 3 Respondents' employment status before joining MSc/MA programs

Case no.	Employer	Job category	Position	Primary responsibility
01	ZARD	Extension	Expert	Extension/communication
02	ORARI	Research	Junior researcher	Extension/research
03	ARARI	Research	Junior researcher	Research/extension
04	ARIPA (Investment promotion)	Research		Identification of opportunities and problems for investment
05	NGO	Extension/development	Program officer	Coordinating livelihood and food security program
06	BARD	Extension/regulation	Team leader	Coordination and resource management
07	–	–	–	–
08	ZARD	Extension/development	Team leader	Coordination and resource management
09	RARD	Extension and development	Team leader	Coordination and resource management
10	ATVET	Trainer/educator	Department head	Coordination and resource management
11	ARARI	Research	Department head	Coordination and resource management
12	Regional Coop Agency	Marketing expert	Senior expert	Training and technical support to primary cooperatives
13	NGO	Extension and development	Expert	Planning and implementation of social services
14	ATVET	Trainer/educator	Department head	Coordination and resource management
15	WoARD	Extension and development	Supervisor	Overseeing implementation
16	IPMS	Research, extension and development	RDA	Coordination, facilitation, and documentation of activities and lessons
17	ARARI	Research	Researcher	Training, experimentation, technology demonstration and evaluation
18	ARARI	Training and Planning	Expert	Planning training, and monitoring and evaluation of research activities
19	Regional coop	Extension and development	Coordination/ supervision	Coordinating planning, implementing and evaluation of activities in coop development

BARD/ZARD/WoARD (Regional bureau/Zonal office/*Woreda* office of agriculture and rural development); ARARI/ORARI/TARI (Amhara/Oromia/Tigray Region Agricultural Research Institute); ATVET (Agricultural Technical and Vocational Education and Training Institute)

Annex 4 Respondents' employment status after earning MSc/MA degrees

Case no.	Employer	Job category	Position	Primary responsibility
01	ZARD	Extension	Coordinator	Process coordination
02	University	Lecturer	Teaching/ research	Teaching/research
03	ARARI	Research	Researcher	Research
04	–	–	–	–
05	ILRI	Research	Research technician	Assistance to scientists
06	NGO	Extension/ development	Dairy resource business specialist	Business plan, training on dairy value chain, technical assistance
07	IPMS/ILRI	M&E	Expert	M&E data collection, analysis and reporting
				Training partners
08	ZARD	Poultry multiplication centre	Manager	Coordination and resource management
09	NGO	Extension/ development	Deputy executive director	Coordination and management of development project
10	NGO	Extension/ development	Project officer	Coordination and resource management
11	University	Teaching/research	Lecturer	Teaching and research
12	NGO	Extension/ development	Health insurance specialist	Coordinating, promoting and overseeing community-based health insurance
13	NGO	Extension/ development	Senior expert	Commodity value chain coordination/ capacity building
14	University	Teaching/research	Lecturer and head	Teaching and research and coordination
15	University	Teaching/research	Lecturer	Teaching and research
16	IPMS	Research, extension and development	RDA	Coordination, facilitation, and documentation of activities and lessons
17	ARARI	Research	Researcher	Coordination, experimentation, on-farm testing and evaluation
18	ARARI	Planning and human resource	Expert	Training planning, monitoring and evaluation
19	University	Teaching/research	Lecturer	Teaching/research

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Canadian International Development Agency

Agence canadienne de développement international

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