A systems and partnership approach to agricultural research for development Lessons from Ethiopia

T. Abate, B. Shiferaw, S. Gebeyehu, B. Amsalu, K. Negash, K. Assefa, M. Eshete, S. Aliye and J. Hagmann

Correct citation:

T. Abate, B. Shiferaw, S. Gebeyehu, B. Amsalu, K. Negash, K. Assefa, M. Eshete, S. Aliye and J. Hagmann (2011) *"A systems and partnership approach to agricultural research for development – Lessons from Ethiopia*", in Outlook on AGRICULTURE Journal, Vol. 40, No. 3: 213-220

A systems and partnership approach to agricultural research for development

Lessons from Ethiopia

Tsedeke Abate, Bekele Shiferaw, Setegn Gebeyehu, Berhanu Amsalu, Kassaye Negash, Kebebew Assefa, Million Eshete, Sherif Aliye and Jürgen Hagmann

Abstract: *In spite of the availability of several improved agricultural technologies generated by the research system in Ethiopia over the last four decades, adoption of these innovations by smallholder farmers has been very low. This has led to stagnation of agricultural productivity and low crop yields, exposing the country to recurrent food shortfalls and national food insecurity. The old approach to agricultural research emphasized developing new technologies mainly through on-station research that were then supposed to reach farmers through the public-sector extension system. The Ethiopian Institute of Agricultural Research (EIAR) has in recent years introduced a shift in agricultural research for development, which is based on the innovation systems approach that involved cultivating partnerships with several actors along the value chain, especially farmers, farmers' cooperatives and input suppliers. This paper presents the methodology used to facilitate agricultural innovations and the diffusion of new technologies and illustrates the outcomes of this initiative with regard to technology adoption, productivity growth and the market orientation of production. The authors use examples from experiences in scaling up three grain legumes. Compared to the three-year baseline average (2003–05), crop output increased nationally by 89%, 85% and 97% in 2008 for common bean, chickpea and lentil respectively. Nationally, 53–59% of the output growth is attributable to yield growth due to technological change, while the balance is due to area expansion. These results affirm that the new approach has led to accelerated adoption of new and high-yielding or low-risk varieties.*

Keywords: *scaling up/out; technology dissemination; value chain; partnerships; innovation systems; tropical legumes*

Tsedeke Abate (corresponding author) is Project Coordinator, Tropical Legumes II, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), PO Box 39063-00623, Nairobi, Kenya. E-mail: t.d.abate@cgiar.org. Bekele Shiferaw, formerly with ICRISAT-Nairobi, is now Director of the Socio-Economics Programme, International Centre for Maize and Wheat Improvement (CIMMYT), PO Box 1041-00621 Village Market, Nairobi, Kenya. E-mail: b.shiferaw@cgiar.org. Setegn Gebeyehu, Berhanu Amsalu and Kassaye Negash are Researchers with the Ethiopian Institute of Agricultural Research (EIAR), Melkassa Research Centre, PO Box 436, Adama, Ethiopia. Kebebew Assefa, Million Eshete and Sherif Aliye are Researchers with EIAR, Debre Zeit Research Centre, PO Box 32, Debre Zeit, Ethiopia. Jürgen Hagmann is a Team Leader, Institute for People, Innovation and Organizations (PICO), Postnet Suite 341, P Bag X 10, 0047 Elarduspark, Pretoria, South Africa. E-mail: Jurgen.Hagmann@picoteam.org.

Coordinated agricultural research in Ethiopia has undergone significant changes both in structure and capacity since its establishment in the mid-1960s. Large numbers of crop varieties and associated production technologies have since been developed and released. Critical mass of expertise has also been built and there has been a good tradition of research culture in the system (Abate, 2007). However, there has not been a culture of including value chain development in the research and development process. The predominant model for dissemination relied on extension as a transmission for technologies developed by researchers, with clear boundaries through mandates and regulations. Despite the availability of substantial information and knowledge that the research system has developed over the last four decades, technology adoption has been slow, crop yields are very low and the agriculture sector has not seen sustained breakthroughs (Abate, 2006a; Abate *et al*, 2006).

The Ethiopian Institute of Agricultural Research (EIAR) has spearheaded a shift in its approach to agricultural research for development (AR4D) in recent years towards broader partnerships in an innovation systems and value chain framework. The initiative started with a facilitated learning process among research managers and scientists through a sequence of workshops and iterative practical experimentation with a simple innovation system model in early 2004. In this paper we describe the methodology used to inspire researchers, and illustrate outcomes and implications of this initiative using the examples of scaling up common bean (*Phaseolus vulgaris*), chickpea (*Cicer arietinum*) and lentil (*Lens culinaris*) in the Arsi and East Shewa zones of the Oromia region in central Ethiopia. The initiative included a range of other commodities and technologies that were equally successful, details of which have been published elsewhere (Abate, 2006b).

Background

The common bean, also known as haricot bean, used to be commercially grown mainly in the central rift valley of Ethiopia in the late 1960s and early 1970s, but its commercialization ended with the advent of the socialist government in the mid-1970s. Chickpea (*Cicer arietinum*) and lentil (*Lens culinaris*) are two of Ethiopia's traditional legumes widely grown by small-scale farmers. The research system has released 30 varieties of common bean (from 1973 to 2007), 13 varieties of chickpea (1994–2007) and eight varieties of lentil (1984–2004). Research results and recommendations on production technologies have also been available, at least since the mid-1980s (Ali *et al*, 2008; Fessehaie and Nefo, 2008; Tadesse, 2008), but productivity has remained stagnant or has even declined in some cases until recent years. None of the three crops was able to break the 1,000 kg/ha yield barrier outside research farms. The incremental gains in total production have been obtained from increases in area expansion rather than from increases in yield per unit area.

The challenge

The three grain legumes in Ethiopia are orphan crops primarily grown by subsistence farmers; farmers' investments in labour and inputs for these crops have been very minimal. Mostly, marginal land is used (especially in the case of common bean); the seeds are broadcast in seedbeds that are poorly prepared; little or no fertilizer or other inputs are applied; improved varieties and agronomic practices have been adopted in few cases; weeding is rarely done. There has not been a viable seed system for legumes to provide good-quality seed of improved varieties in adequate quantities; the existing formal seed sector was able to provide about 27% of the total national seed demand of all crops in the 2005 crop season (Byerlee *et al*, 2007). In the case of the common bean, farmers sell their grain soon after harvesting to pay for the cost of labour for other crops (mainly tef, *Eragrostis tef*); farm-gate prices were very low, and thus farmers had no incentive to produce more than for their subsistence.

On the other hand, the government plan in 2004 called for a 2.47-fold increase in the export volume of grain legumes within five years (MOFED, 2006), and the pressure on research to provide good-quality seed varieties and the accompanying crop management technologies was very high.

Methodology

The learning process and the innovation platform model

One of the biggest challenges to change the mode of operation in putting research into use was the mandate-driven mindsets of disciplinary researchers and managers who had lived in a linear model of innovation for most of their professional lives. Their responsibility for a technology ended after the development of the technology and the blame for non-adoption was with extension.

As a response to this challenge, a learning process was designed for a group of sector and research centre directors and scientists to enable them to understand conceptually and develop the practical skills to facilitate and implement a down-to-earth functional model of innovation platforms and value chain approach. A key focus of this learning process was on the disciplinary and civil servant mindsets, and the patterns of behaviour which so often hamper an entrepreneurial drive to make things happen and take responsibility and championship through to success at farmer level.

The group was taken through a systemic competence development process (Hagmann *et al*, 2009c) with a sequence of workshops and iterative practical experimentation using an innovation system approach in an action learning/research mode. The most crucial competence areas developed in an iterative way were:

- development and facilitation of innovation platforms and commodity value chains and the required partnerships to achieve them;
- personal and team development to overcome inhibiting behavioural patterns and to develop the entrepreneurship and creativity needed to make success happen at farmer level (rather than hiding behind mandates); and
- organizational development to support and manage alternative approaches by the research system with its processes and structures.

As a first step, the existing practice, with its low success rate, was analysed in depth and to the extent that a considerable amount of discomfort emerged in the researchers and managers, as their life mission was to make a difference in farmers' lives and they were shown that the professional reality was far removed from this goal. The energy from their discomfort was used to explore behavioural patterns and alternative ways of creating the desired impact. Possible successful technologies were then explored and considered as options for scaling up. A simple innovation platform model that corresponded well to the situation was introduced. This model had been developed by Hagmann and colleagues from 1999 and had been used successfully in several countries (Hagmann *et al*, 2009a). It consists of a series of steps towards developing functioning innovation partnerships/platforms along sections of a value chain. The platforms can be at different levels, which are defined by the innovation challenge. The key steps are:

(1) Identify a problem or a challenge with high potential for successful intervention (in our case, for example, the new legume varieties may be seen as an opportunity).
(2) Formulate an innovation challenge that clearly defines the focus and scope of the platform (for example, how to scale up legume technology in the Arsi and East Shewa zones to a level at which substantial yield increases and increased income could be achieved by smallholder farmers).
(3) Identify the functions required to make the system work in response to the innovation challenge (for example, organized farmers, continuous supply of seeds and inputs, technological advice, credit, functioning markets, transporters and traders, certain infrastructure, etc).
(4) Identify the actors who can deliver these functions and who have a demonstrated competence in doing so (this can be done in an initial brainstorm mode followed by a thorough stakeholder mapping in the areas/districts).
(5) Invite the promising actors and identify the systemic bottlenecks that inhibit the system from working properly. Identify the mutual expectations of the actors in order to make the system work. Come up with actions to improve it and implement short cycles of review and continuous improvements.

The skills and attitudes of researchers and managers required to take stakeholders through this process were developed iteratively, and after each main step in developing the platforms in practice they came back into a workshop to process their experience and to develop the skills and methodology for the next steps. In total, five workshops with practical platform development processes in between were carried out within one year. In each workshop all three competence areas described above were addressed in an integrated rather than a modular way. This enabled participants to contextualize the insights and change their mindsets and behavioural patterns in action and under peer support and pressure.

The facilitation played a key role through continuously bringing out the inhibiting patterns based on the experiences and examples of participants, and confronted participants with their own behaviour and mindsets in a positive and supportive way, combined with the development of conceptual understanding and skills to make progress. This methodology is called 'facilitation for change' (Ngwenya and Hagmann, 2009).

Naturally, not all the researchers and managers became effective facilitators for innovation platforms, but there were enough who did for highly successful platforms to be created.

Partnerships

Partnerships for scaling up crop technologies included all key stakeholders in the value chain: research – including the national agricultural research system (NARS) and Consultative Group on International Agricultural Research (CG) Centres – farmers, extension, non-governmental organizations (NGOs), farmers' cooperatives, the private sector, parastatals and local government administration.

The NARS research provided the knowledge, foundation seed, training and monitoring and evaluation (M&E); the CG Centres helped with capacity development; farmers' co-ops were instrumental in providing inputs (seed & fertilizer) and distribution, credit, improved bargaining power for farmers and market access; farmers provided their indigenous knowledge, land and labour, and also played the role of seed producers after the piloting stage; the private sector was involved in seed production, marketing and providing information on quality requirements; NGOs participated in training, financing and M&E; extension (the Ministry of Agriculture) provided the local knowledge and participated in M&E; parastatals were involved in seed production and input supply; and the local government administration provided policy support.

Technologies promoted and intervention sites

The technologies promoted included improved crop varieties with good market demand and resistance to disease and insect pests, plus improved management packages (including proper land preparation, optimum plant density and timely weeding). Field days were organized at crop maturity stages – all key stakeholders participated and both electronic and print media reported the events of each field day in various vernaculars, locally and nationally. Training of trainers course sessions were offered to technicians, development agents and selected farmers.

The scaling up work for the three grain legumes reported here was carried out in a total of 14 *weredas* [districts] across East Shewa and parts of Arsi zone of Oromia region, central Ethiopia, at altitudes ranging from 1,400 to 1,900 m above sea level and with annual rainfall ranging between 600 and 900 mm, starting during the 2004 crop season. The farming system consists of crops and relatively large numbers of livestock. Typically, the cropping system comprises roughly 83% cereals, 10% pulses, 4% oilseeds, with the balance covered by such minor crop groups as root crops, vegetables and others. According to the Central Statistical Agency's 2006 crop season data, tef (*Eragrostis tef*), maize and durum wheat are the major cereals, while common bean, chickpea and

lentil are among the most important grain legumes in these areas.

The varieties promoted included the Awash-Melka variety of common bean (released in 1998), the kabuli-type chickpea varieties of Arerti and Shasho (both released in 1998) and the lentil variety Alemaya (released in 1997). Similar interventions were also carried out for common bean in the Bulen, Dibate and Mandura *weredas* of Ben Shangul-Gumuz and Hawassa Zuria and the Boricho *weredas* of the Sidama zone in the Southern Nations, Nationalities and Peoples Region (SNNPR), and the Minjar-Shenkora *wereda* of Amhara region for chickpea.

Measuring the outcome

We used the agriculture sample survey data of Ethiopia's Central Statistical Agency (CSA) (www.csa.gov.et) for the statistics on production. For exports we accessed the records of the Ethiopian Customs Authority (ECA). CSA is responsible for all statistical data in the country; ECA keeps records of exports for the purpose of collecting tax revenues. In order to measure the changes related to the new approach, we used the average of 2003–05 statistics representing the pre-intervention condition and compared this baseline to the latest results of 2008. Clearly, one cannot attribute all of the changes over time to the change in the approach and the technologies promoted. However, comparing the average of the triennium before the introduction of the new approach to the latest round of data is expected to reduce the effect of other exogenous factors (for example, weather conditions). In order to see the effect of technological change and yield growth on production, we used economic methodology to isolate the contribution of area and yield growth on national production for each of the three legumes. The contribution of area A and yield Y increases on production Q are calculated as follows:

$$Q = A^*Y$$

If Q is growing at the rate of r per year,

$$Q_t = Q_0(1 + r)^t = A_0(1 + a)^t\, Y_0(1 + v)^t$$

where a and v are the growth rates for area and yield over time. Taking a simple logarithm of these equations, simplifying and taking anti-log, the growth rate in production can be given as:

$$r = a + v + av$$

This means that the rate of growth of production equals the rate of growth of area plus the rate of growth of yield, plus an interaction factor. The growth rates for production (and by implication area and yield) are computed as follows:

$$r = (Q_t/Q_0)^{(1/t)} - 1,$$

where Q_0 is the value during the base year and Q_t the value after t years.

Accordingly we have computed the value of a and v as indicators on the contribution of area and yield growth rates for the total change in legume production.

Outcomes

Bean production trends for the Arsi zone, Oromia region and the whole country are shown in Table 1. Grain yields at the zonal (1,633 kg/ha), regional (1,307 kg/ha) and national (1,235 kg/ha) levels broke the 1 metric tonne (t) per ha barrier for the first time on a large scale in Ethiopia during the 2008 crop season, compared with the 2003–05 average. This is an increase of 80.9%, 31.7% and 40.1% respectively in yields at the zonal, regional and national levels. This meant yield increases of 685, 321 and 374 kg/ha at the zonal, regional and national levels respectively. In a similar fashion, 259.2%, 88.5% and 89.6% increases in production were registered in 2008 compared with the 2003–05 average at the zonal, regional and national levels (Table 1). Cultivated area for the same period increased by 148.4%, 43.3% and 35.1% at the three levels respectively. The number of smallholder farmers growing common bean increased by roughly 20% at all levels. At national level, the contribution of area and yield growth to overall production is 47% and 53% respectively, indicating that this change is not mainly due to area expansion and that access to new technologies and institutional innovations had a significant impact on productivity. The effect of productivity change on production is highest (42%) in the Oromia region, compared with 35% in the Arsi zone.

Table 2 shows production trends for chickpea. As for common bean, chickpea yields broke the 1 t per ha barrier at the zonal (2,076 kg/ha), regional (1,261 kg/ha) and national (1,337 kg/ha) levels. In other words, there were 89.5%, 22.9% and 38.6% yield increases at the zonal, regional and national levels respectively (Table 2). This translates into increases in yield of 980, 235 and 373 kg/ha respectively at the zonal, regional and national levels. There were approximately 30,500 (192.5%), 41,000 (78.3%) and 142,700 (84.3%) t more chickpea produced in 2008 compared with the 2003–05 average at the zonal, regional and national levels respectively (Table 2). Similarly, there were 7,800 (54%), 23,700 (47.1%) and 58,700 (33.9%) ha respectively more land planted to chickpea in 2008 than the 2003–05 average at the zonal, regional and national levels. The 2008 crop season also saw increases in the number of smallholder households of 16,000 (45.6%), 124,000 (66.7%) and 276,300 (36.9%) respectively at the zonal, regional and national level compared with the base years. Similar to that for beans, the contribution of area and yield growth to overall production is 47% and 53% respectively, confirming that much of the change is derived through productivity growth stimulated through better access to seeds, other inputs and markets for small producers. The effect of productivity change on overall production is highest in the East Shewa zone (62%), where the initial effort of the research system in delivering the innovations to small farmers has focused. But this seems to be spreading to the Oromia region and other areas.

Data for lentil production trends are shown in Table 3. Lentil yield in the East Shewa zone was 1,558 kg/ha in 2008, contrasted with 806 kg/ha during the base year of 2003–05 average – an increase of 93.6%. This is the first time lentil yield has exceeded 1 t per ha in large-scale production in Ethiopia. Yield differences between the base year and the 2008 crop season at the regional and national

Table 1. Common bean production trends at zonal, regional and national levels.

Year	Holders (thousands)	Ha (thousand)	Kg/ha	Metric tonnes (thousand)
		Arsi zone		
2003–05	80.1	9.4	903	8.5
2006	91.1	9.6	1,195	11.4
2007	80.7	13.3	1,364	18.2
2008	95.8	23.2	1,633	37.9
% change[a]	19.7	148.4	80.9	349.0
CPG (%)[b]	–	65	35	100
		Oromia region		
2003–05	960.2	102.2	993	101.5
2006	1,102.2	104.1	1,073	111.7
2007	1,025.1	116.7	1,143	133.4
2008	1,165.1	146.5	1,307	191.4
% change	21.3	43.3	31.7	88.5
CPG (%)	–	58	42	100
		Ethiopia		
2003–05	2,041.8	197.7	881	174.2
2006	2,338.1	223.4	997	222.7
2007	2,147.9	231.4	1,043	241.4
2008	2,457.1	267.1	1,235	329.8
% change	20.3	35.1	40.1	89.6
CPG (%)	–	47	53	100

Notes: [a] 2008 compared to 2003–05; [b] CPG – contribution to productivity growth.
Source: Based on data from CSA (www.csa.gov.et).

Table 2. Chickpea production trends at zonal, regional and national levels.

Year	Holders (thousands)	Ha (thousand)	Kg/ha	Metric tonnes (thousand)
		East Shewa zone		
2003–05	35.2	14.5	1,096	15.8
2006	32.7	14.4	1,477	21.3
2007	46.1	18.1	1,639	29.6
2008	51.2	22.3	2,076	46.3
% change[a]	45.6	54.0	89.6	192.5
CPG (%)[b]	–	37	62	100
		Oromia region		
2003–05	186.0	50.4	1,026	51.7
2006	216.2	57.6	1,374	79.2
2007	262.9	66.8	1,350	90.2
2008	310.0	74.1	1,261	93.4
% change	66.7	47.1	22.9	81.0
CPG (%)	–	67	33	100
		Ethiopia		
2003–05	749.4	174.3	964	168.0
2006	802.5	200.1	1,269	253.9
2007	960.8	226.8	1,265	286.8
2008	1,025.7	233.4	1,337	312.1
% change	36.9	33.9	38.6	85.5
CPG (%)	–	47	53	100

Notes: [a] 2008 compared to 2003–05; [b] CPG – contribution to productivity growth.
Source: Based on data from CSA (www.csa.gov.et).

Table 3. Lentil production trends at zonal, regional and national levels.

Year	Holders (thousands)	Ha (thousand)	Kg/ha	Metric tonnes (thousand)
		East Shewa zone		
2003–05	21.7	3.8	805	3.1
2006	40.8	10.6	1,401	14.9
2007	36.2	11.1	1,222	13.6
2008	40.6	14.2	1,558	22.1
% change[a]	87.7	275.4	93.6	626.0
CPG (%)[b]	–	75	25	100
		Oromia region		
2003–05	185.2	18.6	673	12.5
2006	296.1	33.3	978	33.0
2007	257.8	34.6	909	31.5
2008	223.0	31.7	963	30.5
% change	20.4	70.9	43.1	144.0
CPG (%)	–	62	38	100
		Ethiopia		
2003–05	646.3	71.2	677	49.1
2006	801.8	97.1	835	81.0
2007	805.0	107.4	876	94.1
2008	700.2	94.9	998	94.8
% change	8.3	33.4	47.5	97.0
CPG (%)	–	41	59	100

Notes: [a] 2008 compared to 2003–05; [b] CPG – contribution to productivity growth.
Source: Based on data from CSA (www.csa.gov.et).

levels were also substantially higher, with 963 kg/ha (43.1% increase) and 998 kg/ha (47.5% increase) respectively. In other words, there were yield increases of 753, 290 and 321 kg/ha respectively at the zonal, regional and national levels (Table 3). In terms of total production, this meant that lentil production at the zonal, regional and national levels respectively was higher by 18,400 t (488.9%), 17,500 t (135.3%) and 45,700 t (92.8%) in 2008 compared with the 2003–05 average. The area planted to lentil in 2008 was higher by 10,400 ha (275.4%), 13,100 ha (70.9%) and 23,700 ha (33.4%) at the zonal, regional and national levels than it was during the base year. Similarly, the number of households growing lentil grew by 18,900 (87.7%), 37,800 (20.4%) and 53,900 (8.3%) respectively at the zonal, regional and national levels. Table 3 also shows that, at the national level, the contribution of area and yield growth to overall production is 41% and 59% respectively, further confirming that the increase in lentil production is mainly attributable to productivity growth induced by the change in the scaling strategy.

Ethiopia's foreign currency earnings from the three legumes showed substantial and sustained growth from 2003 through 2008 (Table 4). The combined earnings jumped from US$9.2 million in 2003 to US$83.3 million in 2008, a nine-fold increase. There were 38.4-, 28.9- and 5.9-fold increases in earnings from chickpea, lentil and common bean exports respectively. In a similar fashion, the combined export volume grew from 36,100 t in 2003 to 126,700 t in 2008, which was a 3.5-fold increase. Export volume for lentil, chickpea and common bean grew by a

Table 4. Value (thousand US$) of Ethiopia's exports of dry common bean, chickpea and lentil to various regions of the world.

Region	2003	2004	2005	2006	2007	2008	Total
				Common bean			
Europe	3,335	6,580	6,333	5,681	10,622	15,686	48,237
Middle East	1,455	5,347	3,934	5,359	12,945	18,243	47,283
Africa	1,580	3,374	3,566	4,407	5,821	9,164	27,912
SE Asia	1,641	1,819	1,336	2,525	4,657	3,998	15,976
The Americas	233	569	556	656	960	1,224	4,198
Subtotal	8,244	17,689	15,725	18,628	35,005	48,315	143,606
				Chickpea			
SE Asia	29	671	1,098	5,944	14,587	8,760	31,089
Middle East	508	166	206	3,045	6,339	14,990	25,254
Africa	134	163	346	704	1,565	2,407	5,319
Europe	0	44	139	44	456	234	917
The Americas	21	8	32	267	375	151	853
Subtotal	691	1,053	1,822	10,003	23,320	26,543	63,433
				Lentil			
SE Asia	57	17	0	0	3,797	2,613	6,484
Middle East	58	154	304	15	944	4,194	5,668
Africa	175	170	204	178	296	1,603	2,628
Europe	0	0	0	2	173	49	224
The Americas	2	4	4	3	117	2	134
Subtotal	293	346	513	198	5,327	8,461	15,137
Grand total	*9,228*	*19,087*	*18,060*	*28,829*	*63,652*	*83,319*	*222,176*

Source: Based on data from Customs Authority of Ethiopia.

factor of 26.8, 17.3 and 2.2 respectively (Figure 1). Kassie *et al* (2010) reported a similar situation for chickpea export.

Conclusions

Using the pre-adjustment phase of 2003–05 as a baseline, comparison of the data for the 2008 main crop season shows that substantial gains have been made in the production and productivity of all the three crops at zonal, regional and national levels. For the first time, yields of the three legumes broke (or nearly broke) the 1 metric tonne per ha barrier on a large scale, with common bean, chickpea and lentil giving national average yields of 1,235 kg/ha, 1,337 kg/ha and 998 kg/ha respectively. Compared with the base year average, crop yields have increased by 354 kg/ha (40.1%), 373 kg/ha (38.6%) and 321 kg/ha (47.5%) for common bean, chickpea and lentil respectively. The differences at the zonal level, where the scaling up work was carried out, were even more spectacular, with chickpea, lentil and common bean giving 980 kg/ha (89.5%), 753 kg/ha (93.6%) and 703 kg/ha (80.9%) yield advantages over the base years' average respectively. Total earnings from exports of the three crops showed a 5.4-fold increase in 2008 (US$83.3 million) compared with the 2003–05 average (US$15.5 million); total export volume jumped to 126,700 thousand t in 2008 in contrast to 59,400 t in 2003–05. Unlike in previous years, these changes were accomplished through increased productivity rather than through area expansion. The data show that, compared with the three-year baseline average, crop output increased nationally by 89%, 85% and 97% in 2008 for common bean, chickpea and lentils respectively. For common bean and chickpea, 53% of the output growth is attributable to yield growth, while the balance is due to area expansion. For lentils, about 59% of the production growth is due to yield growth. These results reaffirm that the new approach has led to accelerated adoption of new and high-yielding or low-risk varieties. A significant portion of the production change is attributable to changes in productivity of land

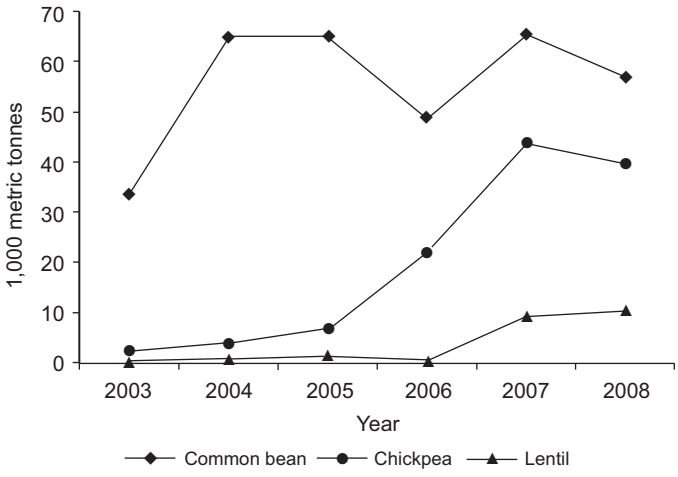

Figure 1. Export (volume) of grain legumes from Ethiopia. *Source:* Based on data from Customs Authority of Ethiopia.

due to use of new varieties and improved management practices. This increase in productivity and relative returns to legume production also seems to have contributed to area expansion in the targeted zones. The country has benefited in terms of greater commercialization and export of pulses, which have increased by 110% in volume and 358% in value of exports.

The overall gain and impact of the new approach, which led to greater diffusion of knowledge, technologies, inputs and innovations to increase yields and market access for the small producers, can be expected to grow further in future as farmers currently unreached through this initiative will also become beneficiaries. Recognition of the benefits gained from this approach led to the entire national research system adopting it, and increased demand by the federal government to engage in scaling up available agricultural technologies across the country. The successes have been attributed to, among other factors, change in the mindset of researchers, availability of relevant technologies by a better linking of service providers with farmers, emerging market opportunities and the catalytic effect of bringing together major actors along the value chain.

Key success factors

One can always ask, 'Why has this not happened on its own before?' There were several factors that appear to have been critical in triggering this success.

The first of these factors was the availability of relevant technologies and technically competent people – in this case the legumes technology, on which many years of scientific research had been spent, was a foundation for the success.

Emerging market opportunities were also a key factor in fuelling the initiative, as were strong farmers' organizations.

Most critical was the catalytic effect of bringing all these elements and actors together to function as a system to deliver success. It required the 'software' to make the players play together, negotiate their roles and hold each other accountable for delivering their respective parts at the right time and to the right quality.

The catalytic effect came predominantly through the facilitation and partnership development process implemented by the researchers after their own change process. The change of mindset in the researchers, and the commitment and entrepreneurship which followed that change, were critical in catalysing the scaling up efforts of EIAR and its partners in Ethiopia.

The simple and practical innovation platform model was also critical in motivating the researchers to try out alternatives. Its simple logic helped them to grasp it quickly and relate it to real-life situations in which things work in a similar way.

Key lessons

The case described in this paper points to a number of lessons for similar initiatives on scaling up and putting research into use.

Often the ingredients for a successful scaling up and/or research-into-use process are within the system, but do not work as a system. Therefore, it is frequently not so much technology failure that inhibits uptake as a failure of the institutions and actors to make the system work as a system. A catalytic effect is required to create that coherence and integration and the commitment of the actors to drive the process from inside and make it work. The facilitation of this process is critical and the skills and attitudes to do it successfully are vital for such initiatives.

Driving such initiatives in the public research sector requires a considerable change of mindset and of the pattern of the typical civil servant mentality. It requires entrepreneurial individuals with a total commitment to success at the farmer's level which is stronger than institutional rules and mandates. Once this dedication and energy prevails, people will always find ways to solve problems and deal with the challenges, and will not give up until they succeed. Such energy and creativity have to be developed. As this process of change relates to deep-rooted personality issues, it cannot be effected by 'training' *per se*. A change in mindsets and behavioural patterns can be brought about by confronting people with their own mission and allowing them to experience the discomfort of failing to achieve it – rather than through preaching change or debating highly theoretical innovation system models. Facilitation in a systemic competence development process seems a promising way to encourage behavioural change and to develop the competence to achieve it, at the same time changing behaviour and the competence to do it.

In hindsight, it would have been better to involve other actors, such as extension workers, more closely in the implementation of this initiative. Naturally, success can lead to jealousy in those who consider such work their mandate but were not adequately involved. The broader institutional framework and setting need to be well prepared for such initiatives, in order to allow the space for work to be successful and remove potential roadblocks.

The time, too, needs to be ripe. Such initiatives must grasp opportunities as they emerge. The right leadership is needed, as are other key ingredients such as markets and technologies – and all are needed at the right time. Despite all the effectiveness of competence development, therefore, the same effect in different situations cannot be expected.

References

Abate, T. (2006a), 'Research works in Ethiopia', id21 insights, website: www.id21.org/insights/insights61/art01.html.

Abate, T., ed (2006b), 'Successes with value chain', *Proceedings of the Conference on Scaling up and Scaling out Agricultural Technologies in Ethiopia, an International Conference, 9–11 May 2006, EIAR, Addis Ababa*.

Abate, T. (2007), *Focusing Agricultural Research to Address Development Needs: Direction for Agricultural Research in Ethiopia*, EIAR, Addis Ababa.

Abate, T., Assefa, S., Hagmann, J., Ahmed, S., Kumsa, T., and Stroud, A. (2006), 'Agricultural innovation systems and partnership in practice: value chain successes in Ethiopia', paper presented at *Innovation Africa Symposium, 20–23 November 2006, Kampala, Uganda*.

Ali, K., Chichaybelu, M., Abate, T., Tefera, T., and Dawd, M. (2008), 'Two decades of research on insect pests of grain legumes', in Tadesse, A., ed, *Increasing Crop Production through Improved Plant Protection, Volume 1*, Plant Protection Society of Ethiopia, Addis Ababa, pp 39–84.

Byerlee, D., Spielman, D. J., Alemu, D., and, Gautam, M. (2007), *Policies to Promote Cereal Intensification in Ethiopia: A Review of Evidence and Experience*, IFPRI Paper 00707, IFPRI, Washington, DC.

Fessehaie, R., and Nefo, K. (2008), 'Review of weed research in highland and lowland pulses', in Tadesse, A., ed, *Increasing Crop Production through Improved Plant Protection, Volume 1*, Plant Protection Society of Ethiopia, Addis Ababa, pp 133–166.

Hagmann, J., Chuma, E., and Ramaru, J. (2009a), 'Putting innovation platforms in action – guide to a multi-stakeholder approach to getting research into use', website: www.picoteam.org.

Hagmann, J., Kibwika, P., and Ekwamu, A. (2009b), 'Learning to make change: developing innovation competence in African universities', in Scoones, I., and Johnson, T., eds, *Farmer First Revisited*, Practical Action Publishing, Rugby, pp 238–246.

Hagmann, J., Peter, H., Chuma, E., Ngwenya, H. J., Kibwika, P., and Krebs, K. (2009c), 'Systemic competence development – an approach to develop the facilitation capacity to manage systemic change and performance enhancement', website: www.picoteam.org.

Kassie, M., Shiferaw, B., Asfaw, S., Abate, T., Muricho, G., Teklewold, H., Eshete, M., and Assefa, K. (2010), *Current Situation and Future Outlooks of the Chickpea Sub-sector in Ethiopia*, Working Paper, ICRISAT, Nairobi.

MOFED – Ministry of Finance and Economic Development (2006), *Ethiopia: Building on Progress. A Plan for Accelerated and Sustained Development to End Poverty (2005/06–2009/10), Volume I: Main Text*, MOFED, Addis Ababa.

Ngwenya, H. J., and Hagmann, J. (2009), 'Facilitation for change: triggering emancipation and innovation in rural communities in South Africa', in Scoones, I., and Johnson, T., eds, *Farmer First Revisited*, Practical Action Publishing, Rugby, pp 220–228.

Tadesse, N. (2008), 'Review of research on diseases of legumes', in Tadesse, A., ed, *Increasing Crop Production through Improved Plant Protection, Volume 1*, Plant Protection Society of Ethiopia, Addis Ababa, pp 85–132.