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Striving for Higher Impacts in Agricultural Research and Development

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Abstract: Over the years, substantial investments in agricultural research have been made in sub-Saharan Africa. The few studies on research investments show impressive returns that are comparable to those achieved in developed countries. However, problems such as recurrent hunger, poverty, food insecurity and natural resource degradation continue to plague the region. Agricultural development arena is changing rapidly toward non-linear innovation systems of complex actor networks and multiple sources of innovations characterized by dynamic and iterative learning processes that constantly inform, renew and advance the state of the systems. Most actors and institutions are not linked effectively often from imaginary boundaries created by prescribed mandates and parochial interests. While more investments in research and development are required for the region, it is becoming increasingly difficult to justify them in the wake of competing needs in the face of shrinking national budgets. The few impact assessments that have been carried out in the region have been incidental and not linked to the research planning cycle implying that lessons from previous research efforts are not used when planning for subsequent research and development efforts. We are proposing impact orientation to track impact to the attainment of institutional and overall development goals. This calls in part for impact assessment to be made an integral part of planning, monitoring and evaluation along with appreciation of the impact chain and actors involved in the innovation process to demonstrate relevance to development goals and thus justify funding.

Introduction

Human population in sub-Saharan Africa will reach 1.2 billion by the year 2025 from its current level of about 611 million (Thornton et al., 2002). This will have profound implications for agriculture in all regions of the continent. Demand for cereals in sub-Saharan Africa will treble to 150 million tonnes by 2020 (IFPRI, 1995), but supply is likely to be outstripped by this demand even under the most favourable projected response scenarios. Most tropical soils suffer from physical soil loss from erosion, nutrient deficiency, low organic matter, aluminium and iron toxicity, crusting and moisture stress (Place et al., 2003). Most farmers practise mixed farming where they pursue a wide range of crop and livestock enterprises that vary both within and across major agro-ecological zones. In most mixed smallholder systems, adoption of economically sustainable land management practices is constrained by shortage of land and capital resources. Many farmers struggle to produce in poor environmental conditions with few tools for coping with drought, pests, disease and poor access to markets. Agricultural research is needed to help these farmers reduce their risk, improve their productivity, and protect their natural resource base.

Many countries in sub-Saharan Africa showed impressive growth from the 1960s to the 80s. As the newly independent countries realigned research and development efforts to address issues facing the new African clientele, there was corresponding growth in research capacity and centralization. This growth slowed down from the 1980s as a result of financial and economic crisis that faced the region. The state responded in part by moving away from being the sole provider of many goods and services and encouraged the private sector to take over non-core activities. The period from the 2000 is characterized by rapidly evolving environment, as well as multiple research and service providers. With waning donor support, Increasingly, National systems are getting decentralized, are emphasizing better utilization of exiting capacity, are more outward looking, client oriented and impact driven (IAC 2004). Public spending of agricultural research fell from 0.8% of agricultural gross domestic product in 1981 to 0.3% in 1991 (Pardey and Beintema, 2001).

Declining research funding has been based partly on the premise that available technologies would be sufficient to solve most of the existing agricultural problems. Only four out of some 24 African countries indicated that agricultural science and technology as important in their poverty reduction strategy papers. The most frequently cited problems were rural infrastructure, development of markets, extension and advisory services, and diversification out of agriculture (Chema et al., 2003). These issues are consistent with strategies of regional research organization supporting the argument that if the perceived problems were tackled, then exploitation of exiting technologies could be carried out more effectively. However, while this may hold for the short term, medium and long term strategic and applied research must be supported (IAC 2004).

Over the years, sub-Saharan Africa has had its fair share of investments in agricultural research and development (McCalla 1999). The few studies on potential returns from investments in research show impressive returns that are comparable to those achieved in developed countries (Gryseels, 2000). Rates of return from 163 impact studies in Africa show impressive median rate of 36% with an average of 47% much higher than the opportunity cost of capital estimated at 12% (Alston et al 2000). However, there is scepticism in the figures arising from potential biases on choice of studies to flaws in methods used. Some argue that the studies are often biased on success stories totally ignoring failures which are common phenomena in research. Most methods are criticized in that often data are unavailable or incomplete and that attribution of the benefits is never tackled exhaustively. To make the situation worse, food insecurity, hunger, poverty and, natural resource degradation continue to bedevil the region. This raises doubts on the potential contribution of research to higher agricultural performance and ultimately providing better living standards for rural communities. While national statistics may not reflect much increase in productivity growth in major commodities, the attractive rates of return suggest that productivity would have stagnated or declined at a greater rate than has occurred with investments in past research. Still, there is a strong feeling that research has been under funded and increased funding is required for Africa to get close to the green revolution of Asia (Chema et al., 2003).

Poverty and hunger remain serious concerns in sub-Saharan African where most people depend directly or indirectly on agriculture for their livelihoods. To achieve the goal set by the World Food Summit of reducing by half the proportion of extremely poor and hungry by 2015, it is essential that smallholder farmers become more productive (IAC 2004). With huge population growth and urbanization the challenges of providing more food will strain the already fragile natural resource base in the short run and medium term (McCalla 1999). At national level, policies, institutions and investment which allow broad based income growth that foster sustainable production systems with agriculture as the engine of growth are needed.

Although agricultural research offers large potential benefits to farmers, its indirect effects on alleviating poverty and food insecurity may be even greater. When millions of farmers in Asia adopted high-yielding cereal varieties in the 1970s, for instance, output increased dramatically and unit costs fell by 30–40 percent (Pinstrup-Andersen 2002). This cost savings in turn led to lower food prices and helped boost the number of jobs available off the farms, to the great benefit of poor people in both rural and urban areas. Yet the kind of agricultural research that will benefit small farmers in sub-Saharan Africa is severely under-funded. The private sector does not undertake such research because the expected private financial gains do not cover the costs.

While many agree that continued investments in research and development are required for the region, it is becoming increasingly difficult to justify them in the wake of competing needs and emerging agenda in the face of shrinking national budgets. Yet it is the feeling of many that agricultural research still holds the future of development in the region. Without continuous technological development, the already dismal state would be even dimmer (IAC 2004).

Since evidence of impact seems to be weak in sub-Saharan Africa than elsewhere, the impact question is being asked more frequently at all levels from production, policy and institutions. Thus, demonstrating impact of agricultural research is becoming a precondition for mobilizing additional investments in research and development. There is growing interest in competitive grant funding systems that require

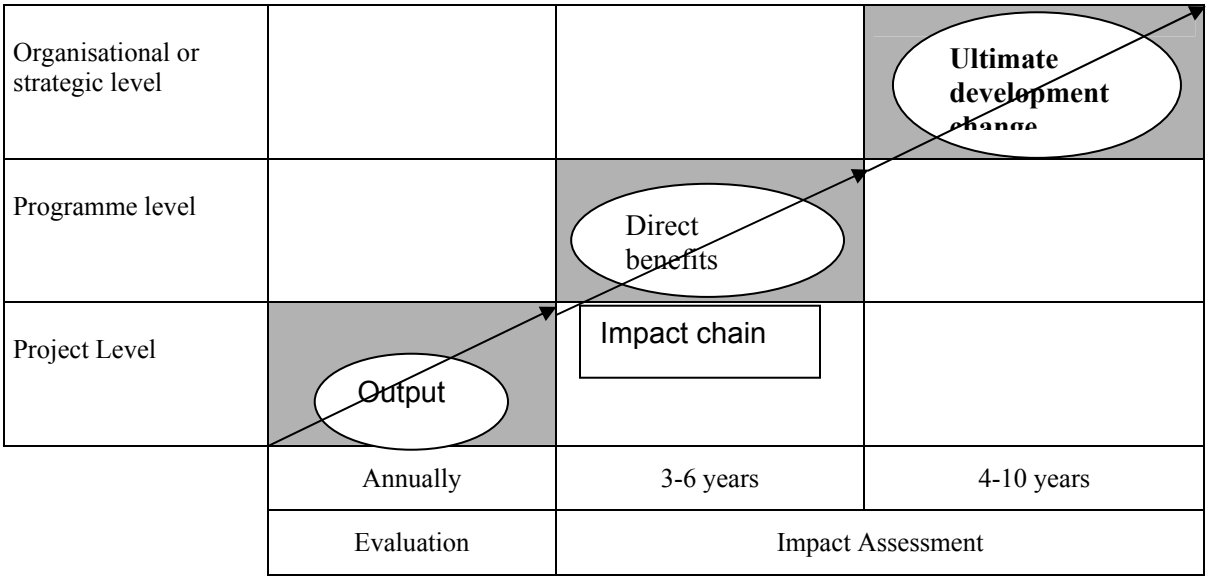
evidence of impact even within short periods of initiation of research activities. Hope lies in strengthening of three pillars of research: delineation of sound priorities; effective self monitoring and evaluation, and more involvement of clients. Agricultural research requires forward linkages with public and private providers of goods and services in extension, credit and other inputs; backward linkages with farmers, cooperatives, farmer organizations and knowledge systems, and lateral linkages with other national, regional, advanced and international research institutions, education institutions such as universities. This calls for new partnerships and alliances since other actors also influence knowledge and innovation. Recognition that research is only one contributor to agricultural development is being emphasized in the national agricultural innovations systems approach.

Impact Orientation

Impact is usually the broad, long-term economic, social or environmental effects at the people level resulting from an intervention (GTZ 2000). Such effect may be anticipated or unanticipated, positive or negative at the individual or organization level and may generally involve changes in both cognition and behaviour. Evaluation on the other hand, is judging, appraising or determining the worth value or quality of research in terms of its relevance, effectiveness and impact. Goals of most NARS are to alleviate poverty and protect natural resources so as to achieve sustainable food security. In east and central Africa, compared with planning, monitoring and evaluation practices are far less developed in agricultural research (GTZ 2000). Most evaluations focus on how research is done and not on results and impacts. The majority of studies measures impact in terms of economic benefit overlooking other important dimensions of development which are difficult to measure or evaluate. This process also fails to take cognizance of how impacts are achieved thereby losing important lessons for future research programs.

The transformation path from seed development to having readily available and affordable maize products involves different organizations over different time frames and constitutes the impact chain (Figure 1) (Hartwich and Springer-Heinze, 2004).

Figure 1. Organizational level and program evaluation



Source: GTZ (2000)

In the case of seed development, improved food security would be the desired impact in the end. For that change to occur inputs will be required to support research efforts to develop an output: e.g., high yielding, disease resistant maize seed.

At the project level, inputs are used to produce the maize seeds. After certain time period several seeds will be available that promise to have the desired impact at the people level. At this time, the research system would rightfully celebrate success for delivery of an output as was planned. Other outputs would be in the form of reports, journal articles and post graduate degrees. However, at this stage we cannot talk of impact since availability of the seed has not yet brought any changes at the people level. Further efforts are required to change the outputs into outcomes.

The road to impact starts when the seeds start to find their way to the farmers through awareness created by the extension services and availability of the seed at the local markets along with requisite inputs e.g., fertilizers. At this stage we expect outcomes manifested in uptake of the new innovations. After successful growth supported by availability of pesticides and technical advice, and when the maize is finally able to reach the market owing to availability of adequate marketing infrastructure then we get closer to the ultimate target. The gap between the projects direct benefits and its development outcomes forms the attribution gap according to the GTZ impact model (Douthwaite et al., 2003). This gap cannot be spanned using a linear, causal bridge but requires plausible assessment of the project's direct benefits and wider level impacts. This may involve triangulation of data sources, blending of quantitative and qualitative analyses and verbal testimony (Douthwaite et al., 2003). Although the role of research declines gradually, it may be called upon again to provide solutions to some unforeseen effects such as susceptibility to new diseases. Researchers must surely have an interest with the whole process so as to learn lessons for future work. When consumers are finally able to access different products from the super seed, then we can start to reap the benefits arising from investment in research and development. The consumers benefit from lower prices and farmers benefit from increased yields or reduced production costs per unit area. When there is a reduction in food insecurity and hunger, impact can be felt. Effective linkages and communication with key players along the pathway will hasten the movement on the road to impact and ensure that future efforts to further reduce food insecurity and hunger are informed. Thus work to bridge the attribution gap is required during the life-span of a project and should not be left to *ex-post* impact assessment. Impact chains need to be identified early on to guide the project on necessary stakeholders and partnerships that need to be formed. Also, baseline surveys are planned in the onset of the project for future *ex*-post impact assessment.

Demand for impact orientation stems from the recognition that public policy reforms associated with funding particularly with poverty reduction strategies and associated expenditure frameworks require research and development organizations to have clear accountable and attributable measures of performance to demonstrate their impact (Smith and Sutherland, 2002). Emphasis is also being placed on client orientation through decentralized programmes that imply the need for joint monitoring and evaluation that focus not only on broader client perspectives but also on results and service delivery. This is placing a lot of pressure on the NARS where lack of evidence of uptake and impact of products and services is prompting doors to question the organizations' efficacy and existence. In addition, there is a shift in the management of aid programmes towards greater partnership between donors and developing country institutions (IAC 2004). The monitoring and assessment of the performance of such partnerships requires a more profound and balanced understanding of the issues of institutional development.

Many NARS grapple with problems of capacity to carry out evaluations and assessment. Where capacity and skills exists, they are in so much demand that there may not have enough time to carry out all assessments. An additional problem is that data for carrying out meaningful evaluations are lacking partly due to lack of effective planning monitoring and evaluation units. This is partly tied to lack of recognition by the reward system of efforts in monitoring and evaluation since other efforts such as publications may be more visible and encouraged. Also many people associate monitoring and evaluation with policing and are afraid to be part of it lest their activities be found to be failing and no one wants to be associated with failure.

Way Forward

This approach being proposed in a regional ECAPAPA/ASARECA/GTZ project that aims to strengthen impact orientation of agricultural research in east and central Africa (GTZ 2004). A regional approach has been adopted to exploit synergies and spill-overs across agroecological zones and farming systems and improve coordination of agricultural research for cross cutting issues that involve many countries. The project will link with a diverse range of resource people; develop and adapt methods and approaches through three comparative plot cases; act as a resource centre for the region enhancing spill-over effects. NARS will be encouraged to learn from each other about best practices and in the process exploit synergies, thereby increasing effectiveness and reducing the costs of what could be an expensive undertaking for one institution.

At the NARS level, few impact assessments have been carried out in east and central Africa region. The few that have been carried out have been incidental and not linked to the overall planning framework of research. Thus pertinent lessons from previous investments are not brought to bear in planning for subsequent research and development efforts (Omiti et al., 2000). To an extent the NARS are not fully to blame for this turn of events. Organizational structures often discourage development of synergies since they encourage organizations to just focus on their outputs within their mandate areas. For example the NARS mandates are often restricted to production of hard (technologies) and soft innovations (e.g., knowledge and information). The assumption being that there would be effective extension service provider who will take the innovations to the end users. Sometimes collaboration between biophysical scientists and socio-economists at the research level is weak. There should be an increase in the number and quality of linkages and communication within and between actors and institutions, to develop common understanding identification of dominant forces of change and working together to effect positive change. Often, the task of ensuring that technologies and innovations reach the desired target group is left to the extension agents which often fall under different line ministries with those of the NARS. There are imaginary boundaries between institutions created by prescribed mandates and interests that slow down innovation process. There is a need to harmonize approaches and reduce destructive competition in harnessing technology for development. This disconnect creates a healthy environment for shifting blame across and getting nothing done at the target level.

What is required is systematic evaluation of the entire research process. However, this requires resources and institutional backing to carry through. Institutions (rules of the game) are the vehicles that enable research potential to be expressed thereby leading to changes at the people level. The region has a complex

array of institutions responsible for planning, funding and conduct of research and others for dissemination. These are often public bodies with the private sector playing minimal role and at distribution of goods and services. There are NARS, universities, international agricultural research centres (IARCs) which are mainly public and private sector players, non governmental organization (NGOs), community based organizations (CBOs). NARS often act independently of each other and the other players and often with little coordination of separate individual efforts. This brings about the issue of attribution. The attribution problem depends on the output and the role of different actors in the innovation process. It is more pronounced when the output is soft results (advice, knowledge or information) as opposed to hard outputs e.g. finished technologies such as seeds. In the latter case researchers can be said to be the real innovators. In the case of soft results other actors use them in highly complex innovation process to produce a developmental result. This introduces the concept of innovation process. Once this is clear, we should specify impact assessment by some realistic level and clarify the kind of information expected from different actors and at what time horizon.

For agricultural research to be answerable to agricultural development, the traditional linear model of research providing technologies which are forwarded to the farmers by extension agents is no longer tenable. Agricultural development must be based on a non-linear innovation system with actor networks and appreciation of multiple sources of innovations. Due to the complex nature of getting knowledge and innovations to the desired end users, dynamic and iterative learning processes with feedback loops that constantly inform, renew and advance the state of the systems are required.

With impact orientation, we are proposing a change in the culture of management of applying and using impact assessment to attain development and institutional goals. We are proposing that impact assessment be made an integral part of planning, monitoring and evaluation and that the reward systems are adjusted to encourage effective monitoring and evaluation. What is proposed is to start with the end in sight, ensure there are adequate consultations with stakeholders and key clients at all stages of the research process. There should be common agreement on the meaning of terms that are often used casually but have completely different meaning. Often people fall short of the main goal just because it may not be clear that they are answerable at higher levels. Emphasis will be placed on learning lessons from the processes for future planning without leaning only towards success stories but taking time to consider why some aspects do not work out so well. Finally to appreciate the impact chain and other actors involved in the innovation process and engage them to speed up the process towards the development goals. Here a distinction between organizations (formal structures governed by institutional rules which have explicit purposes and are consciously created), is an important input to planning organizing and executing research and overall agricultural policy. This is so because while there may be several institutions (rules and norms) that complement each other, there are also many that conflict with the large innovation system. Seeking such conflicts and ways of minimizing them opens the road to achieving impact.

Impact assessments alone cannot deal with the attribution problem sufficiently. This calls for something broader like impact orientation since research is only one factor influencing change. Many success stories are based on individual efforts and remain isolated since they are not institutionalized. Thus impact orientation will join in the debate on continuation of research to political and institutional change and innovation process.

How can we tell that an Institution is Impact Oriented?

Impact oriented institutions will: desire to have impacts at the people level by ensuring that each step in the process has an impact focus; work on priority areas that have been agreed upon by key stakeholders and end users of research outputs; have inbuilt self monitoring and evaluation procedures, give constant feedback to management; use the feedback to modify on-going activities/plan future activities; and will create incentive and reward systems that will reinforce all the above (Leewuis 2004).

Potential uses of impact assessment are to: help managers provide better and more convincing strategic decisions about future research and development investments; make researchers aware of the broader implications of their research and lack of it; identification of the impact pathway and better informing of

research managers on the complementarities and trade-offs between different activities within a research program.

Impact orientation process requires support from senior management as the end users of the impact results and also providers of research funds. It will involve skilled personnel, time and facilities, credible sources of information and good networks. The efforts from such arrangements will be more rewarding if the process is participatory and open to learning. Impact assessment will continue to grow in importance and evolve from just being a tool for accountability of resource use, but to justify relevance of research in achievement of development ideals.

Conclusions

Despite massive investments in agricultural research in Sub-Saharan Africa, agricultural growth is still slow and many challenges stand in the way of future development. This is raising the question of impact at all levels of research effort.

While research institutions have endeavoured to adjust themselves to cope with an ever growing agenda for development, they are being asked to be answerable to higher development ideals than previously.

One way that research institutes can adopt to achieve impact at the development level is impact orientation. This revolves around the appreciation of the existence of diverse actors in the complex innovation systems and hence the existence of impact chains. The need to achieve change at the people level calls for critical planning, self monitoring and evaluation at all levels of the research process, and greater integration of end users of research products in the research process.

References

Alston, J.M., C. Chang-Kang, M.C. Marra, P.G. Pardey, and T.G. Wyatt. 2000. A meta-analysis of rates of return to agricultural R&D. IFPRI research report no 113. International Food Policy Research Institute. Washington, DC

Chema, S., E. Gilbert and J. Roseboom J. 2003. A review of key issues and recent experiences in reforming agricultural research in Africa. ISNAR research report 24.

Douthwaite, B., T. Kuby, E. van de Fliert and S. Schuldz. 2003. Impact pathway evaluation: an approach for achieving and attributing impact in complex systems. Agricultural Systems 78, 243-265

Gryseels G. 2000. Impact assessment of agricultural research: context and state of the art. In GTZ 2000. ECART/ASARECA/CTA workshop on impact assessment of agricultural research in eastern and central Africa. 14-19, November 1999, Entebbe, Uganda

GTZ 2002. Strengthening impact orientation of agricultural research in eastern and central Africa. Project brief.

Hartwich, F. and A. Springer-Heinze. 2004. Enhancing the impact of agricultural research: an impact pathway perspective. ISNAR briefing paper 66. International Service for National Agricultural Research

IAC 2004. Realising the promise and potential of African agriculture. InterAcademy Council 2004. http://www.interacademycouncil.net/report.asp?id=6793

IFPRI, 1995. A 2020 vision for food, agriculture and the environment in sub-Saharan Africa. In: Badiane, O.Q., Delgado, C.L. (Eds). International Food Policy Research Institute (IFPRI), 1200 Seventeenth Street, NW, Washington DC, USA.

Leewuis, C. 2004. Communication for rural innovation: rethinking agricultural extension. Blackwell Science, Oxford, UK.

McCalla, A.F. 2000. The global agricultural research challenge: meeting the challenge – making and accessing impact with special reference to Africa. In GTZ 2000. ECART/ASARECA/CTA workshop on impact assessment of agricultural research in eastern and central Africa. 14-19, November 1999, Entebbe, Uganda

McCalla, A.F. 1999. Prospects for food security in the 21st century: with special emphasis on Africa. Agricultural Economics 20: 95-103

Omiti, J., M. Waithaka and W. Mwangi, 1999. Situation of impact assessment of agricultural research in the ASARECA region. In GTZ 2000. ECART/ASARECA/CTA workshop on impact assessment of agricultural research in eastern and central Africa. 14-19, November 1999, Entebbe, Uganda

Pardey, P.G., and N.M. Beintema 1997. Slow magic. Agricultural research and development a century after Mendel. ASTI initiative. IFPRI, Washington DC

Pinstrup-Andersen, P. 2002. More research and better policies are essential for achieving the world food summit goals. IFPRI. Washington, D.C International Food Policy Research Institute

Place, F., C.B. Barrett, H.A. Freeman, J.J. Ramisch and B. Vanlauwe. 2003. Prospects for integrated soil fertility management using organic and inorganic inputs: evidence from smallholder African agricultural systems. Food Policy 28, 365-378

Smith, D.R. and A. Sutherland, 2002. Institutionalizing impact orientation: building a performance management approach that enhances the impact orientation of research organizations. Chatham, UK: Natural Resource Institute

Thornton, P.K., R.L. Kruska, N. Henninger, P.M. Kristjanson, R.S. Reid, F. Atieno, A. Odero and T. Ndegwa. 2002. Mapping poverty and livestock in the developing world. ILRI (International Livestock Research Institute), Nairobi, Kenya. 124 pp.