

Embedding research in society: supporting agricultural innovation in a global knowledge economy.

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Abstract

The emergence of a globalised knowledge economy and the contemporary views of innovation capacity that this trend enables and informs provide a new context in which development assistance to agricultural research and development need to be considered. Focusing on the Netherlands, the main argument in the paper is that development assistance should use this emerging scenario to identify niches that add value to the R&D investments of others, particularly activities that help wire up innovation systems, linking R&D to other activities and actors in society. The paper outlines four agricultural innovation priorities and guiding principles for development assistance that could help strengthen national and global innovation capacity. These trends raise many tensions and dilemmas for the development research community in Northern countries. A key message of this paper is that this tension could be better handled if a long a long term vision for development assistance to ST&T was in place that recognised the contingencies of the global knowledge economy and the importance of participation in the resolution of international issues that affect all countries. The paper concludes by suggesting that national development assistance policies on ST&I can not be thought of separately from a countries general ST&I policy as participation in the resolution of international issues is a key elements of a countries comparative advantage and that this requires investments in expertise in the Northern and not just financial assistance to the South.

1. Introduction

This paper reflects on four broad interconnected sets of trends which seem set to shape the way knowledge is brought to bear on agricultural development in years to come. The paper uses these trends and the development research comparative advantage of Northern countries such as the Netherlands to revisits the role of development assistance in the field of agricultural innovation.

These four trends are:

- (i) The co-evolution of agricultural sector dynamics and policy perspectives that view innovation capacity as a function of the behaviour of systems that produce, access, transmit, combine and put into different types of knowledge in ways useful to the wider needs of society.
- (ii) The implications of emergence of a globalised knowledge economy characterised by interconnections at multiple scales, the blurring of the distinction between developing country and developed country concerns; rapid rate of change and the consequent shift in

policy emphasis from on research priorities to the development of flexible adaptive responsive capacities.

(iii) Changes in patterns of development assistance. On the one hand the desire to support research in developed countries rather than support research in the North for developing countries. On the other hand the re-emergence of agriculture and science and technology in the development assistance agenda and the entry a new philanthropic organisation such as Gates investing heavily in R&D.

(iv) Reconsideration of the innovation needs of developing countries in the light of their own development needs – particularly poverty reduction, but also international competitiveness. All with this revaluation comes a re-evaluation of the role of agricultural R&D as part of a wider set of activities, processes, actors and policies, that link up and develop innovation systems and which have received far too little attention in development assistance in the past. the design institutional and governance regimes to make innovation capacity pro-poor are a major challenge.

(vi) New definition of scientific excellence emerging from the development agenda embodies in the millennium development goals and the expanding needs of multifunctional agriculture.

Investments in agricultural R&D should focus on learning how to make innovation process pro-poor. Investments in research for development to be conducted in the North or in collaboration with countries in the South should be restricted topics where the Northern country has a specific comparative advantage in that area of research, for example in a platform technology such as information technology, or where the topic is addresses global issues of interest to both the North and the South, for example climate change. This raises a number of tensions and dilemma for the development assistance community. Developing a long term stable agricultural science technology and innovation policy for the Netherlands would help address some of the uncertainties that tend to otherwise amplify these tensions. The paper concludes by suggesting that that national development assistance policies on ST&I can not be thought of separately from a countries general ST&I policy as participation in the resolution of international issues is a key elements of a countries comparative advantage and that this requires investments in expertise in the Northern and not just financial assistance to the South.

2. Trends in the global economy

Implications of a global knowledge economy.

The first and overarching trend concerns the emergence of a globalised knowledge economy. The world is interconnected at multiple scales, through markets, through research networks through global phenomena such as animal and human disease outbreaks, climate / environmental change and through the increased mobility of knowledge through computing and information technology as well as through the global mobility of expertise through migration and global outsourcing.

There are now a number of issues that are of international concern rather than being a developing country concern alone. A further feature of this trend is that market, technology and other contexts are changing rapidly and raising the need for continuous

innovation. One of the fundamental implications of this is that the policy emphasis on research priorities has become somewhat redundant as priorities are a moveable feast in a fast change world. The emphasis needs to be on the development of flexible adaptive responsive capacities are described above as innovation capacity and which relate to the behaviour of innovation systems.

The co-evolution of sector dynamics and policy perspectives on knowledge, learning and innovation

It is now clear that the agricultural sector is moving into an era of rapidly changing market, technological, social and environmental circumstances that are evolving in often unpredictable ways. The features of the global knowledge economy discussed above can now be seen to be playing out in the agricultural sector is in turn become more diverse and complex. Key features include:

- *Multifunctionality.* The broad range of goals and interest groups the sector must serve: livelihoods for poor people, environmental sustainability, agro-industrial development, sector and technological convergence such as bio-fuels, food safety and eco-tourism.
- *Collective intelligence.* There is no longer a single source of agricultural information and technology and bringing about innovation and change requires a collective intelligence involving collaboration between different knowledge sources.
- *Rapid emergence of new platform technologies relevant.* The results of public and private R&D present new social and economic opportunities, but also raises new questions about societies' relationship with science and its governance.
- *Interconnectedness of scales.* Local production and livelihoods are increasingly connected to global preferences and trade standards through international value chains and to global phenomena like climate change and animal disease outbreaks.
- *Knowledge use-related capacities as a new source of comparative advantage.* The ability to use knowledge to innovate is emerging as a new source of comparative advantage, replacing the traditional importance of natural resource endowments as a source of competitiveness for developing countries.
- *Increasing rate and non-linearity of change.* This increasingly interconnected scenario with its multiple interest groups is contributing to the increasing pace of change and its non-linearity, due to the faster transmission of ideas and the wider set of interactions that now exist between markets, policies and technologies.

There is growing consensus that the way to dealing these dynamics is to focus policy and development interventions on mobilizing knowledge and information to support a continuous process of innovation – where innovation is defined as is the process of creating, accessing and using knowledge and information to create new products, services, production arrangements, and strategies that satisfies social and economic goals. Only by being able to continuously innovate can sectors and countries solve problems and improve practices and, in so doing, cope, prosper and compete in a world that it itself continuously changing.

This ability to use knowledge to innovate is emerging as a new source of comparative advantage, replacing the traditional importance of natural resource endowments as a source of competitiveness for developing countries. The recent emergence of Chile as a major salmon producer, Vietnam as a coffee producer, and Indonesia as a furniture producer are just a few examples of this. And it is not just market competition that is innovation-based. The ability to mobilise and use knowledge is becoming increasingly important in determining how countries cope with climate change, human and animal disease outbreaks, and how they seize opportunities arising from new technological, policy, and market opportunities.

Renewed development assistance support for science and technology

The third trend is the re-emergence of science and technology as a major tool in international development, the new found importance of agriculture and the patterns of development assistance support that are evident in these new initiatives. Partially this is the new and large scale investments in scientific research by organisations such as the World Bank (who has been investing in national agricultural research organisations for many years, but also the CGIAR), and DFID (US\$ 4 billion over the next 4 years, although not all to agriculture). But also the New Philanthropists such as the Gates Foundation with their own vision of the role of research and technology in development and their liking for investing in the development of discreet products such as drought resistant rice.

An allied trend over the last 10 years has been the gradual shift from away from Northern countries to invest in their own national scientific research capacities specifically focused on developing country issues. The preference instead has been to locate research activities more firmly in Southern countries. The logic being that Southern researchers are more sensitive to the local institutional settings and that research is better embedded in to local systems that puts research into use (Hall, 2002). One of the implications has been the gradual shift of research funding from Northern based researchers to their counterparts in the South. (this is discussed further below in the section on tensions in the development research community.)

The shift from a research to an innovation agenda

The fourth trend concerns the reconsideration of the innovation needs of developing countries in the light of their own development needs – particularly poverty reduction, but also international competitiveness. Along with this trend comes the new a re-evaluation of the role of agricultural R&D as part of a wider set of actors, activities processes that link up and develop innovation systems and which have received far too little attention in development assistance in the past.

This does not deny the importance of R&D nor the need to building scientific capacity in countries where it is currently weak -- this its self may be an important way of creating an interface with the international scientific community. Rather this is an issue of emphasis. The most common weakness in the capacity the agricultural sector to innovate

for the poor for the market is the weak patterns of linkages between the key actors in the sector including but not restricted to research organisations (World Bank 2006).

While development assistance has often projected a pro-poor rather than a pro-innovation agenda, the former agenda is unlikely to be met unless capacity to change is strengthened – i.e. innovation capacity. While the design of institutional and governance regimes to make innovation capacity pro-poor are a major challenge, active engagement in the innovation capacity agenda is required to ensure that the gulf between those who can mobilise and use knowledge doesn't become unbridgeable and in the process threaten global stability.

New definitions for excellence in science.

The development assistance now quite firmly focused on an agenda that is articulated in terms of poverty reduction, social as well as economic wellbeing and equity and environmental sustainability. International commitment to this agenda is enshrined in the millennium development goals. In many sense this is part of an ever changing set of demands that society places on science and which science is judged and evaluated and supported. In practice, however, scientific excellence and associated professional recognition remain through traditional means of peer review within the scientific community. The Gibbon's mode 2 utopia of the value knowledge creation being judged by its utility to society is a long way off .

While some donors supporting research place much higher emphasis on development relevance, researchers are often caught between the desire to serve development agendas and professional imperatives of placed on them by dominant notions of scientific excellence – for example publishing in peer review journals. Ironically the CGIAR's governance body for scientific quality – the science council -- although its well place for exploring institutional innovations in expanding the notion of scientific excellence in agricultural R&D, has taken a very traditional view on what this means. This seems out of step with other developments where scientists are being encouraged to embed their work in networks that better connect them to societies needs.

Once again the implication of this trend is that ways have to be found of balancing ways of judging scientific excellence that have served us well in the past, with the more immediate concerns of society concerning poverty reduction, economic growth and environmental sustainability. (The tensions this creates for northern research is discussed below).

3. A diagnostic overview of development assistance to strengthening agricultural innovation capacity.

There is long history of development assistance to agricultural innovation in developing countries with many different trends in thinking and practice emerging. One can also see distinctly different approach by for example the European donors as compared to their

North American counterparts. Multilateral organisations and stakeholder organisations such as the CGIAR have taken a different approach again. The following is a gross oversimplification of this complex history to help highlight some of the major issues and gaps that characterise support to agricultural innovation today.

1. Policies to support innovation policy in Northern countries have historically emphasised R&D capacity and used this as a proxy for innovation capacity. This policy approach works in the context of Northern developed economies where activity is at the knowledge frontier and where R&D derived knowledge is critical for innovation, particularly in the industrial sector. Although views have changed in the Northern policy arena, this line of thinking has had a huge influence on the way development assistance programmes have thought about innovation.

2. The challenges and opportunities of agriculture and rural sector of developing countries are not for the most part at the knowledge frontier. Instead what is often required is the creative application of existing knowledge from different sources in order to meet the requirement for local contexts. R&D often needs to be adaptive and the key challenges are about accessing and combining different pieces of information to enable innovation. When frontier knowledge is required, it is often more efficient to access it internationally and combine it with location specific ideas.

3. As a result of biases outlined in 1#, historically the role of agricultural research as a driver of innovation and agricultural development has been over played in national plans and development assistance. This not to deny the importance of agricultural R&D but rather to place it in the context of the large task of innovation. Weak connections to society and areas of economic activity have undermined the effectiveness of agricultural research as a development tool. Weak mechanism to articulate the demand of poor stakeholders has further limited the impact of R&D on poverty reduction. Generally, the agricultural innovation process has been impeded not by lack of research per se, but by weak linkages between research, other sources of knowledge (local and global) and different agents in the economy.

5. With the international arena increasingly crowded by bi-lateral, multilateral and philanthropic development assistance investments in research, Northern countries like the Netherlands need to choose carefully where they invest. An overarching guiding principle is that investments should to a large degree seek to complement the R&D / technology centric investments made by others. This complementary should focus on building the networks, linkages and enabling environment that connect science to societies needs and which help build innovation capacity in a systems sense -- concerns which have relatively little attention in development assistance in the past as suggested in #3. The Netherlands development assistance tradition has a history of this sort of approach (see below); few other development assistance countries and organisations are investing directly in the development of these capacities; and such a strategy could add huge value to the more traditional investments of others in agricultural R&D

5. Within the overarching need to reduce poverty and safe guard the environment, the innovation priorities of developing countries fall into the following categories. (i) Ensuring the sustainability of productive resources — soil, water and biodiversity -- for all forms of agricultural production (food, energy, timber, fibre, environmental and other services) (ii) Coping and competing in the regional and global value chains; (iii) exploiting new platform technologies for local problems; (iv) coping with global scale challenges such as climate change, animal and human diseases. The following section outlines development assistance options taking into account issues raised in #4 and the priority areas outline above.

Options for supporting agricultural innovation in a global knowledge economy.

Given that Dutch development assistance has a tradition of being catalytic and adding value, it should use a contemporary view of innovation capacity as a way of identifying gaps in current international efforts to support agricultural R&D for development purposes. It is the authors view that it should proceed along the following lines.

Innovation Priority 1. *Ensuring the sustainability of productive resources.*

Guiding principle *Learning to innovate.*

The Netherlands like many countries with a colonial past has a long tradition in tropical agriculture. In the last 40 years or so this has matured into a deep and extensive knowledge of using research for developmental purposes. This has led to the emergence of a number of allied fields and disciplines. These relate to focusing R&D on the needs of specific social groups particularly the poor; and understanding the complexities of the agricultural innovation process. So while tropical agriculture expertise still exists, the comparative advantage of the Netherlands is in combining technical expertise with these allied fields concerned with how to organise pro-poor innovation.

Methodological and institutional innovation around tropical agriculture are an existing strength; these can make a unique contribution to the international community concerned with these issues; and will provide generic knowledge on how to approach the context specific innovation requirements involved in natural resource management – pest management, soil fertility and water management. The convergence of science programme at Wageningen University is a model of this sort of development assistance. Similar perspectives are promoted by the Netherlands organisation The International Centre for Development Orientated Agricultural Research (ICRA), although the emphasis there is on skill development aspect of capacity strengthening. The Royal Tropical Institute has a similar emphasis on innovation. Comparable groups of expertise do not exist in the international agricultural community (notable the CGIAR) nor in other Northern countries in such a coherent form with such an emphasis on innovation and allied perspectives

Innovation Priority 2. *Coping and competing in the regional and global value chains.*

Guiding principle *strengthening global links, creating and coordinating local nodes.*

In fast changing market conditions developing countries need access to international knowledge networks both to get information that signals the need to innovate, as well as accessing sources of knowledge needed to innovate. A number of Northern countries development assistance programmes in past invested in technical research on for example food safety and product development as way of helping countries access new markets, but these have often been disappointing.

Since, by definition these value chains are global and largely dominated by the private sector, a key sources of market and technical information are held by private companies. One route for development assistance is to subsidise links between Southern companies and sectors and their Northern counterparts. This could help build innovation capacity and lead to many social and economic spin offs in the South. For example helping southern producers comply with environmental (pesticide residues) and ethical (labour standards) standards demanded by Northern consumers by collaboration with super markets. In a different model Dutch flower companies have helped establish a cut flower sector in Ethiopia by creating links to market information and technology. This has had useful employment generation outcomes in a country where rural livelihood options are scarce.

In an ideal world Southern companies would link to local private technical service providers to help them respond to innovation signals. Often these private sector providers are absent. Many development assistance organisations feel uncomfortable with supporting the strengthening of private service provision companies, so it could be a useful gap to fill. This may include supporting the creation of private R&D services. Similarly many export sectors lack coordination mechanisms (industry bodies, producers associations) to mobilise knowledge and changes in practice at a sector level in times of both crisis and emerging opportunities. These sorts of institutional developments are another neglected aspect of development assistance, but one that sits well within the new perspective of strengthening knowledge-based competencies and innovation capacity.

3 Priorities. *Exploiting new platform technologies for local problems.*

Organising principle *adding value, promoting pro-poor institutional innovations.*

New platform technologies, such as biotechnology have attracted strong attention from the development assistance community -- building scientific capability, strengthening regulator regimes, and developing technology applications. Unless countries like the Netherlands have a specific technical expertise in specific platform technologies, development assistance should focus on playing a facilitating role. This could involve helping share global experience on applying new platform technologies in ways that address social and economic goals. One way is to support scientist to experiment with pro-poor institutional innovations around the deployment of these technologies – although technical and insituional strengthening often have to go hand in hand. The example of the promotion of the integrated bottom up approach through long term Netherlands assisted biotechnology projects in India and Zimbabwe illustrates how effective this approach can be in strengthening innovation capacity (Clark et al 2003 & 2007.) This could be expanded to other platform technologies in the years to come as

part of an overriding interest in capacity strengthening in an innovation systems sense where institutional change is of equal importance to scientific know-how.

Innovation Priority 4. *Coping with global scale challenges such as climate change.* .

Guiding principle. *Selecting North South win wins..*

Global issues such as climate change are effecting both Northern and Southern countries. Northern countries should contribute to the international efforts to develop global research networks to help deal with these. Some of these issues affect specific Northern countries and this is where investments in frontier R&D are most needed and justified. For example sea level changes associated with climate change are probably of specific importance to the Netherlands. R&D that would help the Netherlands would also help, for example Bangladesh. Strengthening R&D and R&D networks around such common global issues could be an efficient way of leverage Northern expertise and investments for developmentally relevant goals.

Efforts should be made to identify topics where R&D will genuinely be of benefit to both Northern and Southern collaborators. This transparency of agenda would better align the rewards to research for Northern and Southern partners, which can often be unclear, unstated or even clandestine in otherwise well-meaning North South Partnerships. Clear, shared goals would also greatly assist scientific networking and the transmission of knowledge and ideas between the North and the South.

5 Tensions and dilemmas in the development research community.

The trends in development assistance and the agenda set about raise a number of tensions and dilemmas for the development researchers in countries like the Netherlands.

Shifting research from the North to the South.

The obvious implication is that funding for development oriented research for Northern researchers has been or will be reduced. To take the example of the UK, that the author knows well, the governments agricultural research for development organisation (The Natural Resources Institute) contained about 500 professional staff in the early 1990's. The Institute was privatised and became part of a University and now has about 80 staff, roughly split between natural and social scientists. The British government's department for international development has stopped its young professionals programme which placed many young researchers in agricultural development projects. While development orientated researchers are found throughout the British university system, in overall terms their numbers are declining and will certainly decline further.

This raises 2 dilemmas which apply equally to the Netherlands. Firstly if the comparative advantage of Northern countries with a tropical agricultural past concerns institutional innovations in deploying agricultural science, where will the allied biological research capabilities come from to develop these institutional innovations? (this is discussed more below).

Secondly if we are truly entering an era dominated by global research concerns such as climate change, current trends mean that Northern countries will have dwindling numbers of scientists with an appreciation of the international aspects of the topics they are going to need to deal with for both their own national interests as well for developmental concerns.

The shift from hard to soft science.

As discussed above one of the notable features of Netherlands development assistance to agricultural development has been the emergence of expertise in the social and techno-managerial sciences concerning how to organise agricultural innovation as part of the poverty reduction agenda of development. The emergence of this critical expertise has only been possible because of the long tradition and expertise in the hard bio-physical science of tropical agriculture. So while this paper has argued that these soft science are the comparative advantage of the Netherlands agricultural development research community they can't be viewed as entirely separate form from the bio-physical sciences that give them operational focus.

One could argue that the soft sciences on agricultural innovation could be hived off as social and policy research clusters of expertise in a similar way that development studies has traditionally been organised. It is the authors view, however, that that this sort of disembodied development studies research is less valuable the new incarnation of this discipline where social and policy studies on innovation and development are linked to research expertise with a practical operational focus such as business studies, health, agriculture, or Banking. This wider set of research expertise should not all be focused on developing country issues, but rather acts as a source of expertise for collaborative efforts. In this environment key issues of concerns are application and capacity questions rather than ideological critiques of different development models.

Excellence in science

Again the authors experiences on the tensions surrounding excellence in science comes from the UK development research community. The experience there was that while development assistance policies were giving greatest emphasis to the poverty agenda as a measure of excellence in development orientated research, the UK development research community was migrating into the British university system. University funding in the UK is linked to a performance assessment regime known as the research assessment exercise. This is mainly based on the number and quality of peer reviewed journal articles. This has created a much discussed dilemma concerning the trade offs between development relevance and published research quality.

It is clear however what the impacts of this dilemma have actually been. Its probably true to say that the design of the research assessment exercise leaves much to be desired. After all development relevance is only one of a growing number of measures of scientific excellences by different stakeholder constituencies in society. This is certainly not a problem restricted to development orientated research. Countries like the UK or the Netherlands need to think creatively how to address the generic issue of judging the value

of researchers and the knowledge they create in terms that reflect the ever widening demands of society.

6. Ways forward.

Change is very much part of the make up of contemporary professional life. One is, however, left with the impression that the tensions and dilemmas faced by the (Northern based) development research community have been made worse by the uncertainty and indeed unpredictability of national development assistance policies on agricultural science technology and innovation . Sudden and often radical policy shifts are common place and often result form short term political agendas. This often has very immediate and fundamental consequences for the development research community. Funding is suddenly withdrawn, job are lost, research organisation are restructured, privatised or closed and ultimately valuable expertise is lost. Of course the irony is that when development assistance policy recognises then need for national expertise, it is often too late and rebuilding such expertise can take years if not decades.

This is not to say that restructuring of support of development assistance research in most Northern countries was (is) not needed. Nor does it conflict with this paper's suggestions for capacity strengthening-centric ways in which the innovation priorities of the developing world should be supported by the North – many of these would support the restructuring process. The critique here is that the restructuring process has often been badly managed. In particular it has lacked a clear long term vision of the research and innovation needs of the international development process in the 21st century that have been outlined in this paper.

Contemporary thinking on innovation capacity in a globalised knowledge economy -- as outlined in this paper -- can provide this missing vision. It can help identify the types of knowledge needed (including knowledge on how to use knowledge for the types of innovation that society requires) and relative importance of research compared to other as a sources of knowledge. It can also provide a vision of the location of different sources of knowledge and the comparative advantage of different countries in areas or R&D and allied innovation activities. It can highlight that there are global and national dimensions to innovation capacity and that it is in the interest of both Northern and Southern countries to ensure they have the capability to participate productively in the global knowledge economy. Returning the millennium development goals, if Northern countries truly wish to participate in “a global partnership for development”, financial contributions alone are not going to be enough. It also requires that Northern countries have the expertise to be true partners.

Countries like the Netherlands undoubtedly have a critical role in the international development process in the years to come. However this will only happen if they invest in building their own expertise as well as that of others. The precise nature of that expertise is obviously a matter of debate, although this paper argues that the guiding principles suggested by the four identified innovation priority discussed above should guide that debate. Perhaps more critical is that this debate is conducted in the framework

of a long term knowledge-based international development vision of the sort outlined above. Being a long term vision probably means that such strategies and policies needed to be de-linked as far as is practically possible from political process and the short termism and u-turn tendencies of that process. The other fundamental implication is that national development assistance policy on science, technology and innovation of, for example the Netherlands, can not be thought of separately from the Netherlands general ST&I policy. The reason for this being that in the era of the global knowledge economy the ability of a country (developed or developing) to participate in the resolution of issues of international significance will be a key source of comparative advantage.

7. Concluding comments.

The globalised knowledge economy and recent trends development assistance to in agricultural R&D suggest some rather counter-intuitive ways forward for Northern countries like the Netherlands. Firstly while knowledge, including research derived knowledge is going to increasingly important in social and economic development its is not the creation of knowledge (particularly scientific knowledge) is that is going to be the rate limiting step. Rather its is going to be the networks and their attendant properties that countries develop to mobilise and use knowledge that are going to be most critical in the new knowledge-based world order – described here as innovation capacity. Secondly, public investments and development assistance investments in agricultural R&D are probably approaching a new high. What is missing is a systematic effort to develop and consolidate knowledge on how to use science to innovate for development. Thirdly and more paradoxical still is that where Northern countries should invest most in traditional scientific research for developing countries is in areas where the Northern countries stand the most gain for the R&D and the strengthening of internal research networks. For example climate change and in the case of the Netherlands, specifically address rising sea levels. Helping oneself is, in this case at least, is the best way to help others. It is for this reasons that development assistance ST&I policy needs to be integrated into the Netherlands general ST&I policy