

# Embedding research in society: development assistance options for supporting agricultural innovation in a global knowledge economy

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**Embedding Research in Society: Development Assistance  
Options for Supporting Agricultural Innovation in a Global  
Knowledge Economy**

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# Embedding Research in Society: Development Assistance Options for Supporting Agricultural Innovation in a Global Knowledge Economy<sup>1</sup>

Andy Hall<sup>2</sup>

## Abstract

The emergence of a globalised knowledge economy, and the contemporary views of innovation capacity that this trend enables and informs, provides a new context in which development assistance to agricultural research and development needs to be considered. The main argument in this paper, which focuses on The Netherlands, is that development assistance should use this emerging scenario to identify niches where inputs can add value to the R&D investments of others, particularly in 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 also raise many tensions and dilemmas for the development research community in Northern countries. A key message of this paper is that these tensions could be better handled if a long-term vision for development assistance to ST&I — which recognised the contingencies of the global knowledge economy and the importance of participation in the resolution of international issues that affect all countries — were in place. The paper concludes by suggesting that national development assistance policies on ST&I cannot be thought of separately from a country's general ST&I policy as participation in the resolution of international issues is a key element of a country's comparative advantage. This requires investments in expertise in the North and not just financial assistance to the South.

**Key words:** global knowledge economy; development assistance; agricultural research; agricultural innovation; science technology and innovation policy; development research community; international development

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## 1. Introduction

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

These five 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 use different types of knowledge in ways that are useful to the wider needs of society.
- (ii) The emergence of a globalised knowledge economy, characterised by interconnections at multiple scales, and its implications: including, the blurring of the distinction between developing country and developed country concerns; the strategic importance of being able to access global knowledge sources and adapt them to local uses; and the rapid rate of change and the consequent shift in policy emphasis from research priorities to the development of flexible adaptive responsive capacities.
- (iii) Changes in patterns of development assistance. On one hand there is a desire to support research *in* developing countries rather than support research in the North *for* developing countries. On the other hand there is a re-emergence of agriculture and science and technology in the development assistance agenda and the entry of a new philanthropic organisation such as the Gates Foundation investing heavily in agricultural 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. With this comes a re-evaluation of the role of agricultural R&D; its relative importance compared to 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; and the challenge of designing institutional and governance regimes to make innovation capacity pro-poor.
- (v) The redefinition of scientific excellence as emerging from the development agenda embodied in the Millennium Development Goals and the expanding needs of multifunctional agriculture.

The paper argues that an overarching need is to orientate investments in agricultural R&D towards learning, institutional change and thus capacity building of the innovation systems in which research is embedded. It goes on to argue that that investments in research for development conducted in the North or in collaboration with countries in the South should be restricted to 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 one that addresses global issues of interest to both the North and the South, such as climate change.

The emerging scenario of development assistance raises a number of tensions and dilemma for the development assistance research community. Developing a long-term and stable agricultural science, technology and innovation (ST&I) policy for development assistance programmes would help address some of the uncertainties that tend to otherwise amplify these tensions. This paper concludes by suggesting that national development assistance policies on ST&I cannot be thought of separately from a country's general ST&I policy as participation in the resolution of international issues is a key element of that country's comparative advantage. This requires investments in expertise in the North and not just financial assistance to the South.

## **2. Doing agricultural research for the South: Patterns of bilateral development assistance.**

Over the last 10 years trends in European donor spending has been to shift from supporting the research of their own specialised development research community (DRC) to supporting research in the South. The logic being that Southern researchers are more sensitive to the local institutional settings and ways of working and that research is better embedded in local systems that put new ideas and technology into use (Hall 2002 ).

While the trend as been variable across European countries, it has created many tensions in the DRC. It has cut their funding and training. In many countries the critical mass of expertise in tropical agriculture and related topics has disappeared. Clearly it makes little sense for countries like the Netherlands or the UK to train and maintain its own specialist corps of cassava agronomists or irrigation engineers.

Unfortunately instead of defining new role for the DRC many development assistance countries have simply shifted support without considering without giving careful consideration to the contours of the global knowledge economy; the innovation needs of developing countries – and indeed the realities of what innovation actually entails; and the increasing emergence of factors that are of a global concern that can only be resolved by coordinated international efforts and public policies. This lack of a long term well informed vision for S,T&I has often resulted in a process of deskilling with much tacit knowledge lost on deploying research for international development.

Does this matter and what is the comparative advantage of the DRC in these countries? This needs to be considered view of the emerging global knowledge economy and the new perspectives on innovation that come with it. This perspective in turn helps revisit the innovation needs of the south and helps further focus on how development assistance programmes should support S,T&I and define appropriate roles and expertise of their own development research community.

## 2. Trends in the Global Economy

We are in an era that history will remember for 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, through research networks and patterns of international collaboration, as well as through the global mobility of expertise via migration and global outsourcing.

There are now a number of issues that are becoming international concerns rather than being developing country concerns 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, described below as innovation capacity, 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, which is in turn becoming 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. Bringing about innovation and change requires a collective intelligence involving collaboration between different knowledge sources.
- *Rapid emergence of new platform technologies*. The results of public and private R&D present new social and economic opportunities, but also raise 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 exists between markets, policies and technologies.

There is growing consensus that the way to deal with these dynamics is to focus policy and development interventions on mobilising knowledge and information to support a continuous process of innovation — where innovation is defined as the process of creating, accessing and using knowledge and information to create new products, services, production arrangements, and strategies that satisfy 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 is 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 is just an example 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*

These global trends coincide the re-emergence of science and technology on the international development agenda; and the new-found importance of agriculture for poverty reduction in development planning. This is increasingly reflected in the patterns of support in several new initiatives.

Rockerfella and Gates have provide US\$ 150million for the Green Revolution for Africa initiative. Gates has pledged a further US\$ 305 million for agricultural development. DFID has pledge US\$ 2 billion for research over the next 4 years, split between health and agriculture ). Multilateral and bilateral donors will spend US\$ 450million in support of the CGIAR system in 2008. The 2008 World Development report signalled the World Bank's renewed interest although investment plans are not yet known. Add to this the agricultural research budgets for national agricultural research organisations.

The magnitude of funding is of course welcome. For countries planning their overseas development assistance programmes to agriculture, its also important to note the focus of spending. The funding of the new Philanthropists, for example, seems to be very focused on supporting research to development new, discreet products such as the Gates proposed investment in drought free rice. Other funding has gone as block grants to international research efforts such as the CGIAR and its regional counterparts.

More generally what is striking is that the balance between support for research and support for allied activities that will lead to innovation. There certainly are programmes that, for example, address the need to build links between research and the private sector such as the National Agricultural Innovation programme in India. However, overall the balance seems to be towards supporting research.

*The shift from a research to an innovation agenda*

The further 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 revaluation of the role of agricultural R&D as part of a wider set of actors, activities and 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 build up scientific capacity in countries where it is currently weak; this itself 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 of the agricultural sector to innovate for the poor or for the market is the weak patterns of linkages among the key actors in the sector, including but not restricted to research organisations (World Bank, 2006).

While development assistance has often been projected as 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 is a major challenge, active engagement in the innovation capacity agenda is required to ensure that the gulf between those who can mobilise and those who use that knowledge does not become unbridgeable and in the process threaten global stability

*New definitions for excellence in science*

Development assistance is 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 senses this is part of an ever-changing set of demands that society places on science and upon which science is judged, evaluated and supported. In practice, however, scientific excellence and associated professional recognition are still assessed by 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 (see Gibbons et al, 1994) 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 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 -- despite being well-placed to explore institutional innovations while 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 society's needs.

Once again the implication of this trend is that we need to find ways to balance the means 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.

### **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 approaches to it, for example, by 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.

(i) Policies to support innovation 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 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.

(ii) The challenges and opportunities facing the agriculture and rural sectors 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 requirements for local contexts. R&D often needs to be adaptive and the key challenges are about accessing and combing through 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.

(iii) As a result of the biases in outlined in (i) historically, the role of agricultural research as a driver of innovation and agricultural development has been overplayed in national plans and development assistance. This is not to deny the importance of agricultural R&D but rather to place it 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 mechanisms to articulate the demand of poor stakeholders have 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.

(iv) With the international arena increasingly crowded by bilateral, multilateral and philanthropic development assistance investments in research, Northern countries like The Netherlands need to be more careful about 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 activity should focus on building the networks, linkages and enabling environment that connect science to society's needs and which help build innovation capacity in a systems sense — concerns which have received relatively little attention in development assistance in the past, as suggested in point no. (iii). The Netherlands development assistance tradition has long had this sort of approach (see below). Few other development assistance countries and organisations are investing directly in the development of these capacities. Such a strategy could add huge value to the more traditional investments of others in agricultural R&D

(v) Within the overarching need to reduce poverty and safeguard the environment, the innovation priorities of developing countries fall into the following categories:

- (A) Ensuring the sustainability of productive resources — soil, water and biodiversity — for all forms of agricultural production (food, energy, timber, fibre, environmental and other services)
- (B) Coping and competing in the regional and global value chains
- (C) Exploiting new platform technologies to address local problems
- (D) Coping with challenges of a global scale, such as climate change, animal and human diseases.

The following section, taking into account issues raised in (iv) and the priority areas outlined in (V) development assistance options for the Netherlands.

#### **4. 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 continue to do so by using 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 author's view – albeit a view fairly ignorant of the the Dutch development assurance landscape -- 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 is an existing strength. The Netherlands can make a unique contribution to the international community concerned with these issues, besides being able to 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 Dutch organisation, The International Centre for Development Orientated Agricultural Research (ICRA), although the emphasis there is on the 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 and 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 development assistance programmes in Northern countries have, in the past, invested in technical research on, for example, food safety and product development as a way of helping countries access new markets. These have often been disappointing.

Since, by definition, these value chains are global and largely dominated by the private sector, key sources of market and technical information are 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 supermarkets. In a different model Dutch flower companies have helped establish a cutflower 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 about 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.

**Innovation Priority 3:** *Exploiting new platform technologies for local problems*

**Guiding Principle:** *Adding value, promoting pro-poor institutional innovations*

New platform technologies, such as biotechnology, have attracted strong attention from the development assistance community in areas concerning building scientific capability, strengthening regulator regimes, and developing technology applications. Unless countries like The Netherlands have 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 encourage scientists to experiment with pro-poor institutional innovations around the deployment of these technologies — although technical and institutional strengthening often have to go hand in hand. The example of the promotion of the integrated bottom-up approach through long-term Dutch-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 issues. 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 Bangladesh, for example. Strengthening R&D and R&D networks around such common global issues could be an efficient way of leveraging Northern expertise and investments for developmentally-relevant goals.

Efforts should be made to identify topics where R&D will genuinely benefit 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. These include the following:

### *(i) 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, which is one the author is familiar with, the government's agricultural research for development organisation (The Natural Resources Institute) comprised about 500 professional staff in the early 1990s. 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 (DFID) 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 two 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 in order to develop these institutional innovations? (This is discussed in detail 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.

### *(ii) Shifting from hard to soft science*

As discussed above one of the notable features of Dutch 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 sciences are the comparative advantage of the Netherlands agricultural development research community they cannot be viewed as entirely separate 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 author's view,

however, that that this sort of disembodied development studies research is less valuable than 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 act 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.

*(iii) Excellence in science*

Again the author's experiences on the tensions surrounding excellence in science come 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 unclear, however, what the impacts of this dilemma have actually been. It is 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 about 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 commonplace and often result from short-term political agendas. This often has very immediate and fundamental consequences for the development research community. Funding is suddenly withdrawn, jobs are lost, research organisations are restructured, privatised or closed and ultimately valuable expertise is lost. Of course, the irony is that when development assistance policy recognises the 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 21<sup>st</sup> 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 the relative importance of research compared to other 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 of R&D and allied innovation activities. It can highlight the fact 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 to 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 priorities discussed above should steer 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 need to be de-linked as far as practically possible from the 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 The Netherlands, for example, cannot be thought of separately from the general Dutch ST&I policy. The reason for this is that in an 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 of development assistance to 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 be increasingly important in social and economic development, it is not the creation of knowledge (particularly scientific knowledge) that is going to be the

rate-limiting step. Rather, it 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. This paper has described these networks and properties 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 paradoxically still, is that where Northern countries need to invest most in traditional scientific research for developing countries is in areas where the Northern countries stand to gain the most from R&D and the strengthening of international research networks. For example, climate change, and in the case of The Netherlands specifically, rising sea levels. Helping oneself is, in this case at least, the best way to help others. It is for this reason that development assistance ST&I policy deserves a long over due into the general ST&I policy of donor countries.

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