Notes for APGOOD meeting, Tuesday 8 November

For intro
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Making technology work for the poor: governing Science and Technology

My argument – two basic points -

- Technology in agriculture is critical to poverty reduction – beating the productivity gap, especially in Africa.

- But – in addition - technology development must be complemented by technology governance – asking which technologies for whom, and with what impacts?

I welcome re-emergence of debate about S and T in development – much profile recently: Commission for Africa, Millennium project, NEPAD etc.. Within UK – prompted by the parliamentary enquiry on the role of S and T in international development – DFID is now fully engaged in these issues, under leadership of Gordon Conway.

I am a technology optimist too… Over last few yrs in course of my work in Africa I have seen some impressive technology applications which are really improving the lives of poorer farmers.

6 quick examples:

- **Nerica rice** — originally developed by scientists of the West Africa Rice Development Association (WARDA) — is a cross between an ancient, hardy African rice variety and a high-yielding Asian variety. It combines features of both: resistance to drought and pests, higher yields even with little irrigation or fertilizer, and more protein content than other types of rice.

- **Drought resistant open pollinated maize** developed as a result of intensive breeding efforts between the international maize centre CIMMYT and national researchers… Understanding elements of drought tolerance together—gene expression, metabolic pathways, and plant morphology. Combining information from functional genomics, data on sugar levels, and QTL analyses, identify important genomic regions to assist selection.

- **Virus free planting material for bananas** in east Africa – The use of tissue culture enables farmers to plant with material certified as disease and pest free. In many situations this strategy can delay the requirement to use chemical control measures.

- **Soil conservation and water harvesting** by farmers across Africa. Mr Zephaniah Phiri, for example, is a farmer living in southern Zimbabwe and someone who has taught me more about agriculture than all the text books I have read. He has invented a whole suite of techniques for harvesting water which have spread via his small community organisation ZWP, resulting in major benefits in drought prone parts of shtn Africa

- **System of rice intensification** developed in Madagascar originally by a Catholic priest, and now being tried out across the world. Proponents claim this can result in a doubling of yields with lower water inputs through a management system that includes wide spacing after transplanting, no continuous flooding and composting systems to increase nutrients.

Important point is that:

- all are benefiting relatively poor small farmers

but

- different technologies are used – from very high tech to very low tech
- technologies emerge from different sources – from farmers, public research systems, corporations
- different levels of funding and investment have been made – from virtually none to very significant sums

I want to make 3 points though as notes of caution on an excessively technology optimist stance, however:

1. We should beware of over-using the (Asian) Green Revolution analogy. This of course is the iconic period for ag tech led development, with massive gains in productivity resulting from the transfer of HYVs. But let's not forget the other conditions that made the GR a success in parts of Asia (not all areas of course), for some people (not everyone benefited) and why a simple replication in Africa is unlikely. The two decades that preceded the GR in India had seen substantial public investment in human and physical infrastructure – whether research, extension, roads or irrigation systems. The past two decades in Africa have seen exactly the opposite – with structural adjustment and aid conditionality often contributing to the dismantling or undermining of the conditions for a GR.

2. We should not assume that investment in S and T will result in impacts on poverty reduction and livelihood improvement. Much research by the International Food Policy Research Institute and others has shown how returns to investment in ag research are both large and positive overall. This continues to be the case. But the chain of events that link S and T with impact or not straightforward. We cannot therefore assume that – in the end – good science will result in good development. As I will discuss in a minute, we need more discussion about which research for whom?

3. The enthusiasm for S and T investment should not fall into the traps of the past by focusing just on 'big science'. The search for the magic bullet solution is always tantalising for any scientist or funder, but almost always elusive. More science and more big, hi-tech science may not be the answer. The C for Africa recommended investing $3 billion in African centres of excellence. African S and T Ministers met in Dakar September to develop a funding plan with donors. But I wonder whether this focus is appropriate. We have been

down this road before – and it failed. Successful poverty reducing technologies emerge from multiple sources and have impacts because they fit particular conditions.

For me, then, making technologies work for the poor requires, yes, well-funded, top quality science in Africa, but also a range of other things – what I would call the challenge of governing technologies. I want to mention briefly 5 challenges

a) technology priorities and R and D processes
b) technology uptake and spread and the role of innovation systems
c) technology ownership and access and the vexed question of intellectual property
d) regulating technology, dealing with risks and uncertainties
e) funding technology, and the role of public and private sectors and partnerships between them

First, technology priorities and R and D processes.

One of the well documented failings of past research on agricultural science and technology is that it has been top-down, expert driven and has not responded to the needs and priorities of poor people. A combination of incentive systems, organisational structures, and the lack of skills required to link the field to the lab or research station has often prevented appropriate research to be done. This has meant that innovations have remained on the lab shelf or in the research station plot and not reached farmers' fields.

This is changing – DFID for example has provided important support for participatory plant breeding approaches – first in India and now around the world; the international centre on tropical agriculture CIAT, based in Colombia, has pioneered approaches to farming learning and innovation; and of course participatory approaches in various shapes or forms characterise today much on-farm work.

But to really put Farmers First means more than this. In particular this means moving farmer engagement upstream – to the heart of priority setting and funding decisions. It means getting scientists to work with social scientists more – and getting more social science and participatory work into the core research institutions. The CGIAR system has just received a substantial increase in UK funding, but the number of non-economist social scientists employed remains miniscule, for example currently only one full staff member and one post-doc at the international rice research centre, IRRI.

There is a long way to go. It's of course not either participatory farmer led research or science led research. It's both. But users of technology have to be central in any type of research. Good science is about asking the right type of questions – and you can't ask those in agricultural research without a good sense of farmers' contexts and priorities.

Second - and linked – point. How do we ensure technology uptake and spread?

The UK government invested £250m in the ten programmes of the just completed decade long Renewable Natural Resources Strategy. There have been some successes, but also many failures. How can we ensure that the success rate is boosted as DFID contemplates a new round of agriculture research funding?

One key lesson is that we cannot assume that good science and technology will inevitably find its way to needy users, particularly if they are poor and female. In the past technology was assumed to diffuse outwards from the lab or research stations, assisted by extension agents who facilitated a linear, top-down transfer of technology. But this has been shown to be inadequate for most cases.

Instead we need to think in terms of whole innovation systems, linking multiple sites of research with users, via markets, regulatory institutions, policy frameworks and so on. This means research – from the beginning – needs to think about this broader set of issues. Again another reason for not just leaving it to the scientists and technicians.

The DFID funded post-harvest programme has made an impressive start at laying out what this might look like. This is perhaps an example for other programmes and initiatives – including much of the CGIAR system where the pipeline, transfer of technology still prevails, and where an integrated 'research-development-application' approach, advocated by George, is very far off in many programmes.

Again much more work needs to be done in this area, going beyond lip-service rhetorical nods towards innovation systems approaches. DFID's new funding stream for agricultural research, following on from the RNRS, offers a great opportunity for some rethinking.

Third, we need much more debate about the governance of technology ownership and access. And this means addressing head on the vexed question of intellectual property.

The conventional wisdom is that incentives for innovation are increased if the use and property rights of new discoveries are protected. This is the rationale for IP regimes, and the now huge emphasis in both public and private sectors on securing patent protection for new innovations.

A recent issue of the Economist documented how patent registrations are escalating at a phenomenal pace, and that there is an emerging thicket of patents protecting it seems every element and process imaginable. This has been driven in particular of course by the emergence of life science approaches notably biotechnology and genomics. This is affecting agriculture too.

Take the example of the much hyped Vitamin A rice – this is hailed as a success of public-private collaboration and an example of how, in name of development, IP obstacles can be got over. This is true, but over 70 patents reputedly were involved, making the negotiations complex and challenging, even for such a high-profile, PR rich case.

- What about other less glamorous examples?
- What about the insistence on proprietary protection of things that are more key to corporate profits and shareholder approval?
- Should issues of justice, equity and development override private property claims?
- Should the development community be championing open source approaches to agricultural technology?
- Or will the whole patent system just collapse in a mess because of the unmanageability of the process – in terms of registration, approval and enforcement?

Certainly the most successful example of a GM crop in the world is the pirated copies of Monsanto's GM cotton in India which have been taken up by 10s possibly now 100s of thousands of small scale farmers from Gujarat to Karnataka.

These are big questions for which I don't have answers, but as the UK Commission for Intellectual Property Rights noted this is a key area of technology governance which requires searching debate and urgent action.

The GM case of course brings me to my **fourth** point, focusing on how risks and uncertainties are dealt with and how technologies are regulated.

Technology regulation in agriculture, until the biotech revolution, has always been seen as straightforward. A few legislative provisions, some checking of seed quality before release, and some basic health and safety assessment for pesticide residues and so on… and not much else.

This has now all changed. For example: in respect of GM crops, issues of biosafety must be dealt with. In respect of an increasing array of export crops, stringent food safety standards are required.

Regulatory issues now feature prominently in the checklist of developing country agricultural policy concerns.

But what to do? The standard approach – promoted by increasing amounts of development aid assistance – is to transfer regulatory frameworks from Europe or the US and build the capacity of developing country governments to change legislation and implement it.

The problem is that this is not easy. The GM cotton example from India is illustrative. India has, compared to many African countries, a highly developed regulatory system, with biosafety legislation in place and a central authority dealing with GM approval and release. But this did not stop Navbharat seeds releasing GM cotton two seasons before the approval of Monsanto's variety. The consequences for pest resistance, gene pollution and so on are unknown, and will never be known, in such an unregulated environment.

So how should risks and uncertainties be dealt with in ways that work, and protect poor people from illegal dumping or unapproved release of potentially risky technologies?

IDS research on GM crops shows how appropriate regulatory and governance systems need to be built in developing countries in ways that take account of both capacity constraints and market and political contexts. They need to be built from the bottom up in a more inclusive manner, avoiding the dangers of a development aid financed transfer of regulation, following on from a transfer of technology paradigm.

Vast potentials exist for improving poor people's agricultural livelihoods from new technologies – whether thro biotech (and not necessarily GM), nanotech or communication technologies - but these need to be subject to informed democratic public scrutiny and debate, and subject to an inclusive form of regulation that really works, and is not just on paper.

Finally, I want to briefly touch on the funding of technology.

The GR was funded by the public sector – with substantial philanthropic support from US foundations. Today public funds are limited, and all the talk is of the private sector and PPPs.

The familiar argument runs – and of course I am simplifying – that many of the core functions of unwieldy government systems - including technology R and D and delivery - can and should be done at least in partnership with the private sector.

Look at the uptake of hybrid maize – the argument goes - in parts of India and southern Africa, for example: this is private sector driven, providing more choice, and greater quality assurance. This is not just the big boys – Cargill, Monsanto and the rest, but also small outfits with their own seed production and distribution systems.

Hybrid maize seed is one thing, though, but what about cassava or sweet potato or soil and water conservation techniques? The private sector has no capacity and no interest in these, not surprisingly. Why should it?

This is why genetically modified crops available today are exclusively ones that have been developed for a large-scale commercial farm market, mostly in the US. Herbicide resistant roundup ready products cut labour, but this may not be a good thing for poverty reduction.

So – the argument continues - if the public sector does not have the capacity to deliver – particularly expensive R and D intensive, proprietary technologies – then the argument runs, PPPs must be the answer.

There are some emerging examples of where PPPs are beginning to deliver R and D capacity and products which are of use to poor farmers in Africa. The ECF vaccine being developed is one; striga-resistant maize and virus free banana plantlets are others. New institutions, such as the Kenya based African Agricultural Technology Foundation are helping facilitate such new technology alliances.

This is all good stuff, and I don't want to knock it. But, we have to be circumspect about the scope and potential of PPPs to address some of the more fundamental challenges of agricultural development in the poorest parts of Africa, for the poorest peoples.

Private sector R and D outfits just don't have what is required, even in alliance with the public sector. In my view, we should be wary of attention being diverted from the urgent need for good old fashioned public sector research, framed and guided by public good needs and not the beguiling attraction of private sector co-funding through PPPs.

For Africa, as already mentioned, this is not going to be easy or cheap.

A serious debate about the scale of the challenge and how new funds should be best spent is needed, one that reflects seriously on past lessons, and questions some of the simple models being currently touted, whether the high science 'centre of excellence' model or the private sector dominated PPP model.

To sum up and conclude from these 5 reflections. Yes, new investments in science and technology for agriculture – particularly in Africa – are essential. But issues of governance (in the broad sense I have discussed) must go hand in hand. And it is these issues, I would submit, that are both under-explored and under-debated.

Hopefully the launch of the new DFID agricultural policy in a month’s time will begin to redress this gap.