Challenges of Scientific Re-Awakening in the Developing Countries: Action Agenda for the World Summit on the Information Society

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1. INTRODUCTION

The sustainable generation of wealth rests on the solid foundation of scientific research, enabling beneficial and commercially exploitable innovations. This is the route developing countries must take. Developing countries are increasingly awakening to the use of the Internet as a powerful search and delivery medium, enabling efficient two way access to world wide information sources, without which scientific research becomes a permanent state of "follow my leader".

Fortunately, and unfortunately, access to knowledge creates synergy. Greater access leads to more rapid advancement (and if properly managed, greater human development) for those with access. The unfortunate part of it is that those who are ahead consequently advance faster, so that those who are behind are left further back. The knowledge and development gap therefore expands.

The current largely one-way traffic in the knowledge market resulting from the domination of intellectual property by the more developed world is therefore is one of the biggest challenges of the digital divide. In the circumstances, approaching closure of the gap based *only* on closing the infrastructure divide inevitably compounds the situation: the one way traffic will simply flow more efficiently. As has been stated at the International Council for Science (ICSU) fora, the digital divide is being converted into a knowledge divide.

Africa and some development partners are addressing the reality of this and related challenges. Universities, like Makerere University[2], are fighting successfully to restore their academic glory, with the main emphasis being on scientific research and output. ***There is a positive change: facing up to the challenges and a scientific re-awakening***.

This paper starts from a brief discussion of the digital divide challenges, and builds the case for coordinated action through the expansion and improvement of current efforts that will ensure that the digital divide does not become a knowledge divide. ***The specific focus is on enabling developing countries to create and exploit scientific intellectual property.***

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[2] See http://www.makerere.ac.ug/

2. GENERATON OF AND ACCESS TO SCIENTIFIC KNOWLEDGE: THE CHALLENGES

The factors that prevent our countries from joining the knowledge society have been articulated many times. These include:

2.1 Lack of awareness about the opportunities and potential of ICT as a platform or enabler for societal transformation and human development and, more critically, lack of appreciation of the hazards of being left out (or living at the fringes) of the knowledge society. This is probably the greatest challenge of the LDCs.
2.2 Lack of skills to use, manage, maintain, exploit and generate ICT resources and opportunities
2.3 Very low rates of basic literacy and numeracy.
2.4 Very limited penetration, and in many cases total absence, of ICT infrastructure.
2.5 Limited and disproportionately expensive bandwidth for linking into the global highway.
2.6 Lack of enabling environments

With specific reference to access to, and generation of scientific knowledge, especially for LDCs, we can sub-categorise and condense the factors to:

(i)   Lack of awareness and conviction among our leadership about the benefits of joining the knowledge society.
(ii)   Very limited content generated by LDCs, something to sell in the market. Given access to current literature, this is mostly due to limited research experience (both in terms of numbers and expertise of researchers based in country) and facilities for scientific research.
(iii) Limited access to, and high cost of current scientific publications, and limited expertise in identifying, evaluating, and exploiting Internet based sources (internet literacy).
(iv)   Lack of appreciation of intellectual property value or how to manage it.
(v)   Limited and very costly access to the global information infrastructure, relying on expensive satellite rather than optical fibre access to the backbone.

A necessary pre-requisite to addressing these bottlenecks is their recognition by our developing countries, and consequent putting in place policies that create a better environment as well as commitment of national resources. A corresponding co-requisite is that the world community works with developing countries to create a measure of equity in all these issues if our efforts as the scientific community to contribute to the ultimate goals of human development as well as world understanding and peace are to succeed: It is a human characteristic that dissatisfaction is not related to absolute levels of human development, but disparities therein. This is what drives the need to address the divide and to establish an acceptable state of equity.

By rethinking strategy, those of us in the developing countries, working with development partners, have the potential to establish successful methodologies. Emphasis here is on "those of us in the developing countries". Success will not be achieved through simple external prescription but through home grown solutions assisted by the international experience and participation of our development partners and national peers. *We need ownership of initiatives by the developing world as a critical pre-condition to the success of any prescription.*

3. ADDRESSING THE CHALLENGES

3.1 Lack of awareness and conviction among our leadership about the benefits of joining the knowledge society.

This is the first hurdle, addressing a state of mind that stops our people, especially the top leadership where national policies and priorities are set and limited resources are allocated, from putting knowledge and ICTs at the top of the agenda. Yes, everyone talks about the ICTs and the knowledge society now, but deep down, there is very limited perception of their ramifications.   The evidence: a continuing failure by both governments and academic/research institutions to allocate significant resources (human and financial) to addressing the issues. *Without such understanding and commitment, efforts from outside will be dissipated because they are neither owned nor sustainable by the beneficiaries.*

The scientific community has an advocacy role to play here, a role that goes beyond mere repetition of the usual statements about the benefits of ICTs and the knowledge society. ***We must re-package the message, based on researched objective linkages between knowledge access/ ICTs and national/ human development. This is a major research challenge.*** It is not sufficient to cite the numbers of telephone lines and hosts on the internet as evidence that knowledge exploitation leads to economic (and hopefully human) development. The countries normally so cited were still generally the richest when the Internet was born, making an arguable point: what came first, the number of hosts or the wealth to set them up?

Real awareness can only be measured through internal financial commitment. Without attacking the need for military expenditure by LDCs, for example, I pose the question: *what would the national economic and development impact be if limited national resources were allocated to ICTs and knowledge access with the same desperation they are allocated to military spending?*

Action Point 1: Conduct research to establish clear objective linkages between investment in scientific research and ICTs and repackage the awareness message.

Action Point 2: Link international/ multi-national support for initiatives that promote access to knowledge, to demonstrated national ownership, including an acceptable level of financial commitment that will ensure sustainability.

3.2 Very limited content generated by LDCs, something to sell in the market.

This is the second hurdle. Many of our countries have gone through cycles of instability and economic hardship, and the challenge in Uganda for example, was for a long time basic survival. This is a historical given, and is no longer the issue. The issue is the consequence and how to address it: we lost a lot of our researchers to the developed world. We are acutely short of researchers, both in terms of expertise and numbers, and we must rapidly recreate them. We cannot survive sustainably in the knowledge market place if all we ever do is buy: we must produce content, something to take to the market place.

The old model of capacity development that is still used by some development partners failed for one simple reason: by taking our best brains and sending them out to the best international institutions, we simply gave them away in the majority of cases. They became absorbed and integrated in those institutions, conducting research in environments that could not be reproduced in developing countries.

A new capacity building model must be used, and I would like to cite here what I consider a best practice in the current linkage between Makerere University and Swedish universities that is supported by Sida/SAREC[3].

This programme links PhD students and their Ugandan supervisors to Swedish universities and Sweden-based co-supervisors. The programmes are run on a sandwich basis, with exchange visits between the supervisors and short attachments at Swedish universities for the students. The problem to be addressed must be defined by the Ugandans, and be relevant to Uganda's development needs. Current linkages are in Engineering, Medicine, Agriculture, and Social Sciences – the role of Social Sciences being the translation of scientific output to human development. This model develops supervision capacity for the Ugandan academics, and enhances research expertise of both Ugandan staff and students without transplanting and luring away the student from Uganda. The linkage is also helping to establish labs, like the proposed Geographical Information Systems lab, whose cost is out of the current financial reach of Makerere University. Linkages of this nature need to be scaled up.

Action Point 3: Setting up and funding for capacity building models that do not lure expertise away from LDCs, enhance the expertise of researchers (already PhD level) in LDCs, and focus on areas with nationally defined development relevance and priority.

Action Point 4: Parallel with the creation of research capacity, fund the establishment and equipping of laboratories that permit researchers in the developing countries to carry out frontline research.

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[3] The Swedish Agency for International Development, Sida, through its arm for Research Cooperation, SAREC, has committed about SEK 90 million to Makerere University over the last three years to strengthen research capacity, including training PhD level candidates on a sandwich basis. About SEK 35 million of this is for ICT infrastructure and access to online academic literature.

The priority put on universities and research institutions, with their positioning for maximum national impact in terms of training, research and knowledge/ content generation, should be noted.

3.3 Limited access to, and high cost of current scientific publications, and limited expertise in identifying, evaluating, and exploiting internet based sources (internet literacy).

This is the third hurdle. Most areas of scientific research are not locally bound, and no one can conduct research without prompt access to current international literature.

Because of intellectual property issues, current scientific literature tends to be very costly, beyond the cost that can be sustained by African academic and research institutions (especially considering the overall volume of international scientific output). The negotiating power of any single LDC institution in terms of getting lower cost access is very limited, and there is need to work in larger groups not only to establish such access, but to unbundle it with respect to specific databases.

A closely related challenge, again resulting from the sheer volume of literature on the internet, a lot of which is not vetted, is the limited expertise in identifying, evaluating, and exploiting internet based sources (internet literacy).

A successful example that must be cited here is the International Network for the Availability of Scientific Publications (INASP), a programme of the International Council for Science (ICSU). INASP, working through its Programme for the Enhancement of Research Information (PERI) has provided Makerere University (and the whole of Uganda) with access to more than 7,000 full text online journals at a cost of $55,400 per year, with document delivery at $5 per article (rather than about $20) for those articles that are restricted. The objective of PERI is to support capacity building in the research sector in developing and transitional countries through strengthening the *production and dissemination of, and access to, information & knowledge* utilising new Information and Communication Technologies (ICTs). This programme has received major support from Sida/SAREC, Danida and WHO.

One important component of PERI is creating the ability to identify, evaluate, and exploit internet based sources, what is termed here as internet literacy.

Action Point 5: International Support for INASP and its PERI programme, and expanding its role as a neutral negotiating body for academic and research institutions in developing countries that want to access scientific literature, while also pushing for unbundling of access to the various databases. The onus should also be put to developing countries to take a more active participation in both identification of relevant sources and negotiation, to build their capacity for eventually leading the initiative.

3.4 Lack of appreciation of intellectual property value or how to manage it.

The fourth major challenge is the lack of appreciation of intellectual property (IP) value, and the management of such property.

IP rights (IPR), and the approaches to it among developing countries, is the subject of ongoing debate, and it more highlighted than exhaustively discussed in this paper. There are pros and cons for both full protection and open source access. There is however one common factor in both cases: the need for appreciation of intellectual property value, its legal recognition, and development of capacity to manage and exploit IP.

The African culture has different approaches to IP: that which is very closely guarded and passed down from parent to heir, like the medical practices and herbal medicine; that which is very closely guarded and known only to sections of society (male and female) or age groups above a certain age; and that which is openly known and freely passed on. In all cases, the basis of preservation is oral history, and exploitation is limited to those in the immediate know. To put something in the market place, knowledge, suitably protected, must be globally exploited. The dearth of patents held by African academic and research institutions and individuals is not simply because there is no scientific output: it is because, in many cases, the value of such output is not recognized or the mechanisms for protecting it internationally are not available, or, where available, not known and appreciated by researchers.

In discussing IPR, it needs to be noted that with the current status of IP controlled by African countries:

- One hope for Africa in accessing knowledge is through the open source copyright forum, a movement that needs to grow in terms of scope (scholarly articles to software to genetic resources) and coverage (researchers and universities world-wide)
- African scientists and publishers are only just beginning to utilize the potential of disseminating their knowledge through programmes such as African Journals OnLine (AJOL) (a programme of PERI). They have something small to take to the market if they could be enabled to get there.

Action Point 6: Work with African Academic and Research institutions so that they lead in establishing environments where intellectual property value is recognized and protected, with objective targets for generating patents.

Action Point 7: Support for cross-national movements that are working towards the growth of open source copyright as a critical transition stage in the promotion of scientific research in LDCs.

Action Point 8: Back up the ongoing debate on open source with support for objective research of current advantages and disadvantages of alternative approaches to IPR.

3.5 Limited and very costly access to the global information infrastructure, relying on expensive satellite rather than optical fibre access to the backbone.

The cost of Internet access is the fifth major hurdle. To put this in focus: Makerere University pays $19,000 plus 17% VAT for an internet link of 1.5mbps, arrived at as the most competitive option in the country in a tender that included possible ownership of a VSAT. This is about ten times what is paid in developed countries that have access to the Internet optical fibre backbone. When you factor in per capita income differences, a factor of about ten between LDCs and the developed countries, Makerere University effectively pays more than one hundred times for internet access than a university in the developed world.

Until this is addressed, access to online materials in large volumes will remain a very expensive venture and a barrier to research.

A consortium of several African universities in Eastern, Southern and Western Africa (including Makerere University) is conducting a study into approaches to the reduction of internet access cost. The initiative is supported by the "Partnership" foundations (Carnegie, Rockefeller, Ford and MacArthur) who are also working with African universities and libraries to create access to information. This includes regulatory barriers.

Action Point 9: The ITU, as the international body that gives a lot of policy guidance to developing countries on telecommunications regulation, should encourage the recognition of academic and research institutions as deserving of any regulatory decisions that would lead to a reduction in the cost of internet access. The biggest challenge should be recognized as the need for the removal of barriers that stop institutions based in different countries from creating access and negotiating with major Internet access providers as a block.

Action Point 10: Support for regional consortia of academic and research institutions that are working towards low cost of Internet access.

Action Point 11: Support and funding for the penetration of the optical fibre internet backbone into the African continent. This is the realistic long term solution.

4. SUMMARY OF ACTION POINTS

Action Point 1: Conduct research to establish clear objective linkages between investment in scientific research and ICTs and repackage the awareness message.

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5. CONCLUSION

This paper has given a developing country perspective of issues that need to be put on the agenda for WSIS in order to address sustainable human development through enabling knowledge creation based on scientific research in developing countries. The Prepcom is invited to consider and adopt the action points that are based on real experience.