Scientific Research and Information in Developing Countries: Necessity, Threats and Opportunities[1]

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(recherche scientifique, publications scientifiques, pays en développement)
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Abstract

Next to education, also scientific research is necessary at the universities of developing countries in order to reach a full economic and intellectual development for these countries. Good research, however, requires smooth access to the international scientific sources of information, and this as well at the beginning of a project as when writing the final report. While this access used to be very problematic, due to its high cost and to the lack of publishing experience, unexpected opportunities have arisen in the digital era thanks to the Open Access to scientific sources, and also thanks to some special actions from the world of publishers. The role of a university librarian should therefore primarily exist in referring his or her customers to these possibilities.

Necessity

Nowadays, when speaking about scientific research in developing countries, its necessity is probably its least controversial aspect. Indeed, more and more people are convinced of the fact that research is also required in those countries, in order to realise sustainable progress in their intellectual and economical development. The simplest way to correct the paternalistic attitude of the white man who "knows everything best" is to educate the local population up to the level where they can take over all affairs. And here one should dare to proceed up to the highest level of education: that of the researcher who is able to independently find his own way towards new knowledge, instead of only to absorb what others have discovered before.

The concept of "research for developing countries" is often limited to the domains where the needs of a developing society are most urgently felt: medicine and agriculture. These domains are indeed very important for the public health, and they should be studied intensively as well in the North as in the South. Nevertheless, in doing so one should not forget the other domains:

- Technological sciences are very important for the development of a strong economy and of an industry that is driven by more than only a couple of departments of Western companies where manual labour is performed at low salaries.
- Fundamental sciences (such as physics, chemistry, biology,...) are the domains where new ideas are born (and not only new gadgets...). In order to become an independent player in an international industrial world, investing in a technology based on fundamental sciences is indispensable.
- Finally, one should also not forget the humanities. A society without a human culture is an inhuman society, and each country has obviously its own culture and its own history. These deserve to be studied with the same scientific thoroughness as our Western cultures.

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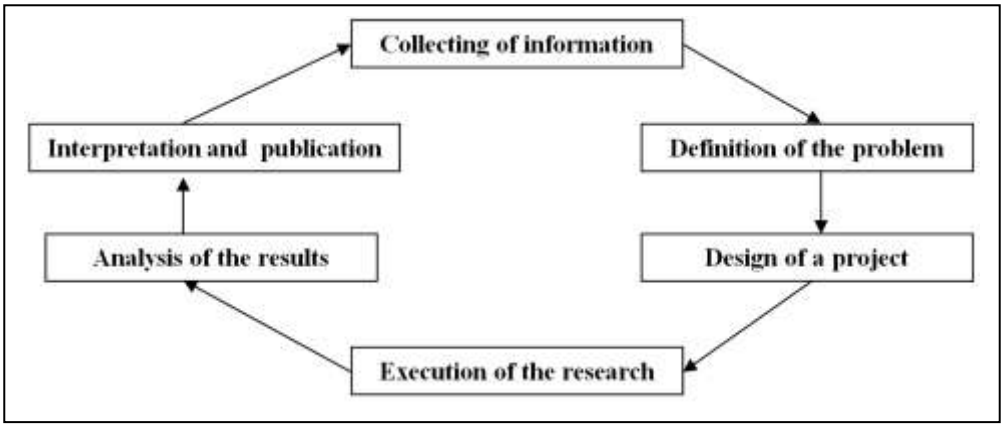
For these reasons, one should also invest seriously in those domains, and not only in education but also in research. Research laboratories are the workshops where scientists are trained who might one day make an industry successful, they are the breeding grounds for new talent!

Scientific Research and Information

The progress of scientific research via various projects is commonly described as a repetition of cyclic processes. There are a number of variations of the steps that compose these processes, but essentially they all contain the following ingredients:

- The collecting of information: making an inventory of what at present is available as universally accepted knowledge in relation with the subject that will be investigated.
- Definition of the problem: determine what is still missing in this knowledge, or in its understanding.
- Design of a research project: decide on the strategy that will be used to tackle the problem.
- The real research activity: this can be of an experimental nature, or a theoretical analysis, or the collection of new data, etc...



- Analysis of the results, interpretation, formulation of a hypothesis that could explain the obtained results or that could bring a new understanding.
- Final formulation of the conclusion and reporting of the results and conclusions: this means a publication with which the newly acquired knowledge is being added to the "universal database of knowledge".

Therefore, the information of scientific knowledge is intrinsically connected with all scientific research: it is its starting point but also its final destination, respectively through reading and publication. The universal knowledge was traditionally stored in the world-wide collections of books and journals of our research libraries; nowadays we are witnessing a shift towards the huge virtual library of digital resources. Information is the strongest common feature of all scientific research. The precise nature of everything that is going on between these starting and end points is strongly domain specific, and very often people commit errors of judgement when commenting from the point of view of their own domain what is happening in a different domain... In the rest of this paper we will mainly discuss the common information aspect of scientific research.

An immediate consequence of this analysis is that – when we say that scientific research is necessary for developing countries – this automatically means that all possible scientific information should be available and this as complete as possible. It also means that at the end of each research project there should be a sound publication about the results. Unfortunately, both requirements are often confronted with severe problems!

Threats

The biggest threat for scientific research in developing countries is not the scarcity of financing, nor the often poor training of the students; it is the absence of information, and this in both discussed directions: the availability of information and the communication of newly obtained information

(or: reading and writing).

It is completely pointless to invest in a research project when it is impossible to implement the initial and/or the final phase of the cyclical project process. Without adequate possibilities for the acquisition of information there is a too high a risk that the research will only rediscover already available knowledge, or – and this is even worse – that it will be derailed into false conclusions when it is based on not certified assumptions.

The three most important channels for the dissemination of scientific information are, in increasing order of reliability:

- Personal communications
- Conference contributions
- The scientific literature (journals, books,...)

Participation in international conferences is very expensive, due to the travel costs, the high registration fees and the fact that they often are organised in big cities with pricey hotel accommodation. Books, on the other hand, seldom contain the most recent information in highly competitive domains, and scientific journals have become extravagantly expensive, so that even most universities in the Western world are struggling with their library budgets in order to satisfy the needs of their researchers. The almost total absence of scientific information sources has therefore always been the first and worst threat for the research capabilities of developing countries.

There is a second threat in the end phase of the research, i.e. the reporting. Research without valorisation through the communication of the obtained results to the stakeholders is a waste of money and of effort. The stakeholders can be very diverse: for local problems, of course, the local stakeholders are most important, but nevertheless also the world-wide society has the right to be informed about the newly acquired scientific knowledge, such that future researchers might continue to build on it and in this way continue the cyclic process.

Researchers from developing countries experience great difficulties in order to have their articles accepted in our journals, and this for various reasons:

- Often they do not know those journals.
- The publication charges can be very high.
- Submitted papers are often rejected, because the research results are considered not to be sufficiently interesting (with or without good reason), or because the authors do not dispose of the necessary skills to write a text in the language and style required by the journal.

Several universities have started publishing their own research journals, and they consider this to be a prestigious proof of their excellence. However, most often these journals are based on very local selection procedures without any serious guarantee for quality, and they very seldom have a noticeable international dissemination. As a consequence, there is no international reporting about the research performed, and this research may be considered as a pure waste of time, except maybe for a number of local applications or as training ground for the researchers involved.

Opportunities

Maybe all this is sounding rather negative and depressing. Fortunately, it rather describes the situation of about 20 years ago, when the Internet was still in its infancy and when digital journals were still a distant dream. In the meantime, the Internet has been well established and it is also available in a large part of the developing world. It can even be expected that the remaining black holes will be filled up in the coming 10 or 20 years, delivering universal access. Of course, the Internet has also given rise to false hopes, and this was especially true in the developed world. Universities and researchers hoped that all their financial problems concerning the high prices of the scientific information delivery would now be solved. And in a certain sense, these problems could have been solved, except for the fact that – for reasons of prestige and for improving their own c.v.'s – most universities and researchers remain attached to the commercial journals that continue

to charge ever increasing subscription prices for the electronic versions of their journals. Nevertheless, there have been a number of developments that were very beneficial for the poor developing countries:

- *The packages of free journals.*

  Some of the most important commercial journal publishers have collaborated (under the name "research4life") to offer a number of packages of journals, either for free (for the poorest countries) or for a very low price (for the somewhat less poor). The best known package is HINARI, containing for the moment already more than 8,000 scientific sources in the biomedical sciences (a couple of thousand journals, but also books and databases). Access is free for countries belonging to the list of "Least Developed Countries" of the United Nations, and for those whose GNI is lower than 1,600 $ per inhabitant. Most African countries fall in this category. There is a second list (for countries with a GNI below 5,000 $ per inhabitant): institutes from this list must pay a yearly contribution of 1,000 $ in order to get access to the whole package.

  There exist analogous packages in agriculture (AGORA with 1,900 journals), in environmental sciences (OARE with more than 4,000 journals) and in general sciences (ARDI), each time with analogous conditions for access. These packages certainly offer a great help in many countries, but there remain nevertheless several problems. Some countries experience enormous differences in wealth, when the majority of the population suffers from extreme poverty while an upper layer of rich people has access to private and rather rich universities. In such countries the publishers preserve the right to refuse the free access to the packages described above, and not only for those rich universities, but for the whole country. A first example can be seen in the Philippines, which officially should be in the second list, but which does not get access to those packages. Another example is Peru, where the situation is slightly less dramatic: they are in the second list and their universities have access through a subscription partly subsidized by the government; in spite of this, however, Elsevier refuses to give access to their information, except for the titles and abstracts: in this way they abuse from those free packages in order to make publicity for their pay-on-demand facility.

  Besides those packages composed by the publishers, there are also initiatives from international organisations giving help to libraries in developing countries, such as INASP with its PERii-programme, and a similar initiative from EiFL. Also here a number of journals in the humanities and in the exact sciences are offered at strongly reduced prices, with the help of a special interface from EBSCO

- *The Open Access movement.*

  "Open Access" is the system through which researchers and/or publishers arrange that through the Internet world-wide free access is given to their publications, with ideally on top of that a copyright licence (e.g., via a Creative Commons statement) permitting the readers to download and use those texts, as long as proper reference is given to the original author(s). The two most important channels to realise such a system are called the golden and the green road, respectively.

  The golden road consist of the publication in an electronic journal that is freely accessible, and the "Directory of Open Access Journals" (DOAJ) already mentions more than 8,000 peer-reviewed OA journals. The most prestigious ones are certainly those of the Public Library of Science (PLOS) and they have very high impact parameters. There exist also large packages of such journals, as e.g. those from BioMed Central, and there is an important contribution from the developing world with the Latin American SciELO and Redalyc and the African AJOL. Some of these OA journals have the disadvantage to charge sometimes high publication charges (as an alternative for the revenue from subscriptions), but most of the mentioned packages from the developing world do not do this. Also our own *Tropicultura* is playing an exemplary role in this respect!

  The green road in some sense originated from an initiative by the high energy physicists, who in

1991 established a central website where all researchers in this domain could upload a preprint of their publications. This database (the ArXiv) is still alive, is now open for a much broader domain of sciences and contains already more than 770,000 articles. Without any doubt, this database has contributed considerably to the very fast development of this branch of physics. Since it seemed impossible to generalise this model unto all other domains of sciences, another model was developed in which all universities should set up their own database (called a *repository*) with the publications of their own researchers. All these databases could then be linked together in a virtual way through a common protocol that allows web harvesters to collect the metadata of all these articles into one huge database. (The harvester BASE from the university of Bielefeld, e.g., already contains information about 37 million articles, coming from more than 2,240 institutes.) Most of these articles are at the same time submitted to a regular journal, where they undergo the normal peer review process.

Both the golden and the green road continue growing. Some people feel that this growth is still too slow, but nevertheless their successes after less than 20 year are remarkable. In Latin America we also see some initiatives (like Red Clara) to foster the green road through the stimulation of institutional repositories and the signing of collaborative agreements.

The fundamental reason why scientists make their contributions world-wide available in Open Access is twofold: on the one hand it provides a fast and broad dissemination of their work, and on the other hand they are convinced of the fact that science can only prosper thanks to the accessibility without barriers to all acquired knowledge. We cannot further expand on these arguments within the scope of the present article, but it is quite obvious that these initiatives have indirectly an extremely useful effect on the information possibilities for the developing world. The only requirement to get access to this wealth of information is the access to the Internet; this is already available, or it is arriving at full speed very soon.

Conclusions

The most important conclusions that I would like to draw from the discussion above are related to the scientific institutions and their libraries, which in developing countries all too often still concentrate exclusively on the traditional way of information delivery. For this reason a lot of attention is given to these problems in the programmes for University Development Cooperation of VLIR and similar organisations. Special points of attention are the following:

- The primary role of scientific libraries and their staff is to provide scientific information to the students and researchers of their universities. Their paper library collections are in general rather modest, and little money is available for the acquisition of electronic resources. Open Access, on the other hand, offers their users a very valuable collection of information, compared to which their own collections are almost negligible. The main problem is that these sources are often unknown to them, unless they find something by accident while 'googling'. Therefore, it is the task of the librarian and information responsible to point their users to these possibilities and to arrange an easy access to all these OA websites, e.g., through the website of the library. This implies a full overhaul of the concept and functioning of a university library.
- Also for their own publications (however modest they may be) these universities should try to use the possibilities of Open Access, in order to reach a much broader audience than with their poor local journals. Initiatives such as SciELO, AJOL and analogous initiatives in Asia help existing journals to transform themselves into free electronic journals that can be produced at a minimal cost.
- At the same time they should try to set up institutional repositories in Open Access, conform to the OAMHP protocol for the exchange of metadata. Several Open Source software programmes are available for this purpose, and it can also be organised in a collaborative network. In this way it will be possible to discover their publications through the international harvesters. It is very remarkable that here an extra obstacle sometimes has to be removed, because local researchers are afraid to offer their publications through these channels: they fear wrongly that

western researchers may steal their results!

- A last conclusion is for ourselves, the universities and research institutes from the western world. Besides all other arguments in favour of Open Access – related to its intrinsic advantages for the progress of science – we should also support this evolution because of its advantages for the developing countries. Open Access means sharing our knowledge with the whole world, and therefore also with the poor countries. In contrast to the sharing of our money, this does not make ourselves poorer in the process, on the contrary!

References:

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        - HINARI, Biomedical sciences: http://www.who.int/hinari/en/
        - AGORA, Agronomy: http://www.aginternetwork.org/en/
        - OARE, Environment: http://www.oaresciences.org/en/
        - ARDI, Research for Innovation: http://www.wipo.int/ardi/en/
- Creative Commons licences: http://creativecommons.org/licenses/
- OASIS: Open Access Scholarly Information Sourcebook: http://www.openoasis.org/
- DOAJ: Directory of Open Access Journals: http://www.doaj.org
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(The websites of SciDev and OASIS are very well suited for finding additional reading about the subjects treated in this text.)