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Abstract

The management of scientific activities efficiently with the aim of development requires that their objectives, methods, roles and their links are clarified. In addition to the three usual research types - basic research, applied research and experimental development, the targeted societal research for decision-making is presented with its specificities. The relevant contrast appears to be less between basic research and experimental development, or between government-driven and society-driven research, than between market-driven research and public-service research. The open knowledge plays here a fundamental role in the evolution of the societies and in their development. The knowledge economy promotes useful research with a technological purpose, which makes very marginal the knowledge production and all what could allow the citizens as the societies to revitalise and redefine themselves, and to answer the present challenges. Eventually, we propose some tracks to strengthen research-developing capabilities in Africa.

Keywords: Research Typology, Knowledge Economy, Research System, Research Capabilities, Economic Development, Africa.

JEL Classification: O30, O31, I21, O10.

1. Introduction

"If we are to take measures that will make a genuine difference to the lives of the 800 million people in Africa, to future generations and the environment upon which so many depend, we need sound and solid science," according to A. Steiner, UNEP Executive Director and United Nations under-general secretary (UNEP, 2006: xxiii). And Darnton (2009) stated that "our [US] republic was founded on faith in the central principle of the eighteenth-century Republic of Letters: the diffusion of light". But for instance at the African level, firstly at the "Science with Africa" conference organized by UNECA in March 2008 in Addis Ababa, the various themes (presentation of research findings, analysis of research conditions, research policies) were

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essentially all given equal importance: there lacked a clear analysis, and even an understanding, of what is research and what is not; of what sets it apart from other human activities. Barely any distinction was made between research, sciences and activities involving scientific knowledge. It is hard to manage these activities efficiently when their characteristics are not known. The preparatory documents for the CODIST I conference[1] give the same impression as well: the terms "science", "technology" and "innovation for development" are typically used together, as if they covered the same thing. This is akin to the opinion of Müller (2009) about the United Nations' Food and Agriculture Organisation (FAO): it thinks that corporate interests drive innovation, that innovation is positive, and that intellectual-property rights are required to stimulate innovation; progress is good because it progresses. What is remarkable about the vision of scientific progress is that the FAO conceives of progress as a "progression" that does not necessarily have a destination. The affirmation in the CODIST I concept note (UNECA, 2008) of a univocal link between experimental development and development is, we feel, equally open to criticism.

Likewise, a distinction must be made between research activities and studies and consulting activities. To ensure clarity of debate and efficiency of actions undertaken, one must define the outlines and activities of research, study and innovation: what are their objectives, methods and roles? How are they different and complementary? In what conditions are they conducted? Who are the stakeholders and participants?

More generally, research, science, innovation and development, and how they inter-relate, must be analysed by adopting a viewpoint that is critical in the scientific meaning of the word, i.e. by evaluating their positive and negative aspects and their contradictions as well.

To discuss these arguments, we focus above on the different types of research, from the basic to the societal research, positioning their relations with experimental development and innovation. We highlight the societal research for public decision in disseminated knowledge society. Then we discuss the meaning of knowledge economy in terms of innovation and open access to knowledge, and the link between scientific activities and development. After all, we propose some tracks to strengthen research-developing capabilities in Africa.

2. The different types of research

There are different types of research: Basic research, applied research, experimental development, societal research.

Basic research, applied research, experimental development

We will first try to discuss the end goals and processes of research. The contrast between basic research and applied research often structures debate, but we feel that this typology is simplistic and does not reflect current challenges. Although the boundaries of classification are by nature hazy and permeable, basic research, applied research and experimental development are the three types of conventionally recognised research, as defined by the Frascati manual (OECD, 2002).

The concept of basic research is by far the best defined. Its purpose is to understand and explain all phenomena and observable facts, or to identify and understand the mechanisms behind the phenomena as it is observed by the researcher, without any particular application or use in view. Its applications and findings are uncertain, its deadlines are unpredictable but always far in the future, and its profitability is random. Its findings belong to human heritage, and so cannot be patented (even though some have tried). Consequently, it receives mainly public funding.

Conversely, experimental development lead to the conception of pilot schemes and to the industrial and commercial implementation of research outputs, which can often be patented. It is essentially funded by the private sector, and its outputs belong mainly to investors.

The boundaries of applied research – which is neither basic nor experimental development – are quite poorly defined in the daily research world. Sometimes, research is said to be applied

simply because its area of application is precisely scoped, without this specifying how the research operates: for example, research will be described as being applied to transport or agriculture. In this case, it is called oriented basic research by OECD. Most often, applied research is defined as an extension of the discoveries of basic research: understanding new mechanisms through the latter can lead, in a totally unpredictable way, to new applications in terms of technologies or services, whose development is the purpose of applied research. Applied research then aims to acquire new knowledge in order to resolve practical and tangible problems or to develop applications, goods and services. Its findings are often considered patentable, and it is primarily conducted by the private sector.

The taxonomy of basic research / applied research is sometimes easy to apply. Reynolds (1998) defines basic research as the foundation of the knowledge base upon which decision-makers rely whilst applied research tends to seek the cause and remedy for an immediate issue.

In biology, basic research will seek to understand a cell mechanism; applied research will possibly develop a drug based on the newly-discovered cell mechanism. In physics, basic research was done on the energy levels of elemental particles; then, with this new knowledge, applied research developed the laser. In the field of mathematics, basic research into algorithmics led to applied-research extensions in the area of encryption systems.

Basic research therefore seems to be the essential foundation for applied research as thus defined. The distinction may even appear artificial, given that one cannot exist without the other. In particular, they are linked by a spiral: discovery of a basic mechanism, which is used to develop a new practical application, which allows new advances in basic research, and therefore the discovery of new mechanisms… Denny (2001) reported that developing countries consider there is rather a need for studies on immediate every day problems than curiosity – driven research. It is more appropriate for industrialized and rich than poor countries. But lack of basic research leads to a poor knowledge and expertise capacity of the nation.

Targeted societal research for public decision-making

The concept of targeted research has emerged more recently: unifying basic research and applied research, it arises from social needs and is commissioned to resolve a concrete issue (Barré, 2004; Joumard *et al*., 2004; Pestre, 2004; Jollivet and Legay, 2005). It is called mode-2 science (Gibbons *et al*., 1994; Nowotny *et al*., 2001) or post-normal science (Funtowicz and Ravetz, 1991; 1995; 1997: Luks, 1996; 1999; Funtowicz *et al*., 1997).

The human sciences contain many examples of such research. To take examples from the field of transport: in psychology, understanding human behaviour in driving situations; in sociology, understanding users' modal choices; in geography, identifying laws that govern spatial phenomena such as urbanisation and transport flows. This research is defined as a response to concrete societal questions, implementing the principles of theoretical research but with constant interaction between field and theory that promotes an understanding of both.

The societal aspect of this research does not necessarily refer solely to the human and social sciences. Research on emissions of atmospheric pollutants by road transport has in the past 20 years highlighted essential parameters such as vehicle operating conditions (speed, gradient, ambient temperature, etc.) and the composition of vehicle fleets. In the field of rail safety, research has shown the importance of maintenance procedures and their optimisation, evaluated in terms of overall transport-system efficiency and not only of short-term profitability. In the environment field, work on the hierarchy of the physical and chemical causes of declining ecological quality of watercourses will allow better organisation of the measures needed for watercourse restoration and the health of local populations. In public health, at-risk groups or risk factors are identified for a given health event in order to choose action priorities according to very non-commercial criteria that are extremely important in citizens' minds (for example, the premature death of the elderly). In agronomic research, recent work has diagnosed the flaws of

the dominant productivist system and shown it is possible to reconcile the profitability of agricultural production with environmental protection; but designing economical and autonomous systems is scarcely compatible with the short-term economic interests of a sector that lives on selling, and even importing, inputs and exporting goods.

This research therefore produces knowledge and explanations of a public, and even social, phenomenon. It often involves measuring and modelling a phenomenon in given spatial and temporal circumstances, and quantifying the role of an influential parameter in order to support the decision-making process (the concept of research for public decision-making is often used).

A second characteristic arising from this type of research is that its findings can immediately be commented upon by all, because the phenomenon under study is a public, social object and the concepts are very similar to mainstream concepts, especially if one bothers to translate the jargon. The fact that everyone can talk about it does not mean, however, that everyone talks about it properly. This is the strength and the difficulty inherent in this type of research. For instance, in the transport-environment sector, citizens highlight the role of congestion, but research highlights rather the role of increasing trip length, the congestion playing a positive role by decreasing the traffic demand.

Lastly, a third characteristic is that this research can be applied almost immediately (if one excludes power-related phenomena and multiple change-resistant factors) and can improve society's mode of organisation by minimising its environmental impact or the risk of accidents or deaths, to repeat the examples given above. The research is not typically applied in the market economy, and therefore does not receive the accelerating boost that profitability gives to a private-sector company. It must be the subject of a collective, political decision.

It is obvious that the basic / applied research typology no longer holds true: in these fields, the characteristics of research activity differ radically from those of basic research, although they are not part of the spiral which links applied research and basic research or in a continuum that adds economic value. This spiral, previously autonomous, is being challenged by the introduction of a major stakeholder: the society as a whole, with its representatives and lobbies. In the environmental field, researchers have highlighted multiple impacts of human activities on the environment, which has helped drive the emergence of social concern about environmental issues and then about the problem of the nature-society-economy schematic of sustainable development, which itself guides research activities, which, in turn, will doubtless yield new social concerns...

In summary, the characteristics of this research, which we prefer to term societal rather than targeted, which is too vague term, could be:

- social utility: its applications are essentially in the field of the collective management of our society, and are not directly market-based. The current debates about sustainable development are one of its most accomplished expressions;
- the non-patentability of its findings, even though the tools developed to obtain these findings can add value and/or be transferred into the market sphere;
- the independence of research authors, which must be ensured by their status, and which alone can guarantee the defence of the collective interest through non-subjection to market interests;
- the highlighting of strong relations between the phenomenon studied and parameters that are generally already known, and which are thus hierarchised and quantified;
- its transversal, often multi or transdisciplinary character, not only drawing on disciplinary contributions but can set up new frameworks beyond them (Funtowicz and Ravetz, 1995; Gibbons, 2000), which cannot be reduced to the concepts of basic and applied research;
- the natural insertion of its findings into public conversation, from the village square to society's big debates;
- it is essentially publicly funded, because of its first three characteristics.

The relevant contrast therefore appears to be between commercial or market-driven research and public-service research not mediated by the market, rather than between a knowledge production system driven by government and academic community on one side and by the civil society on other side, understood to comprise individuals and groups. This last picture forgets the imbalance between the stakeholders with financial, social, cultural and expertise resources, and those without (Saurugger, 2003).

In addition, societal research has the distinctive feature of often developing without, and sometimes against, scientific-research institutions, particularly in so-called alternative fields (organic agriculture, renewable energies, etc.). Some non-governmental organisations are now scientifically more competent than public institutions. In parallel, a rise can be seen in the scientific expertise ability of civil society; this emerging field forms science's third sector.

Societal research experiences the same funding and support problems as basic research. It generates little private profit through directly-patentable applications; its primary target is collective benefit, which may be against corporate logic. It should be steered by the research stakeholders themselves, in association with social demand. Peer review in accordance with appropriate criteria provides the necessary guarantees of research quality, but it includes a wider, more temporary and heterogeneous set of practitioners, collaborating on a problem defined in a specific and localised context (Gibbons, 2000). The short-termism of big corporations' steerage and the opaqueness of direct steerage by ministries and foundations can be a strong barrier to its development. Africa has to develop its own approach for scientific research based on the African culture and environment to respond to African priorities and solve their own problems and to address people's needs (Stigter, 2006).

Disseminated knowledge society

Society's research needs must also and especially include the production of public goods: open knowledge, plural and independent expertise, and non-profit innovation or innovation meeting non-solvent societal needs. However, the production of socially-useful knowledge and innovations is no longer the preserve of traditional public or private research institutions; it is also performed by the emerging third sector of knowledge and innovation, i.e. by multitudes of collectives (patients, farmers, consumers, peer-to-peer digital communities, etc.) which collectively take charge of producing scientific and technical knowledge and must be recognised as equally legitimate partners in public research. In this case, the term used is "disseminated knowledge society", which marks the entry into a finite world where science has a new role to play (precautionary principle, sustainable development). There is thus a need for innovation and research policies to promote clear social and environmental priorities and global concerns.

In this third sector, local communities in Africa also create knowledge and must therefore play a central role in creating local content. Local knowledge spans farming, wildlife and environmental management. The oral tradition is important in Africa as the main way of transmitting knowledge, which is memorised through different generations. Access to local knowledge is difficult for various reasons, especially the low level of development of institutions in most African countries (Raseroka, 2007: 13). As emphasised by the participants in CODI V (UNECA, 2007: 14), there is a need for wider availability and use of traditional and local knowledge, with universities, especially their libraries, being actively involved in the processing and dissemination of this knowledge.

Societal research is what creates the link between scientific knowledge and the multiple facets of society's organisation. It meets society's demand for better self-understanding, by of course incorporating the findings of basic research and of experimental development, and even by developing such research if necessary. Research findings have to be communicated in an understandable terms to government, general public and to local communities (Denny, 2001). It

is therefore essential in guiding the decisions of the individual, the citizen and the elected representative. It is an essential constituent of democratic transparency.

3. The knowledge economy

The knowledge economy is now presented as the new paradigm of science, economics and development. It is defined as the economy in which knowledge is perceived as an essential resource and a factor of production, but also the economy in which knowledge is the main driver of economic growth. It is characterised by four main pillars: innovation, investment in experimental development, human capital development, and incentives and legislation (Tapper, 2007: 10).

The knowledge economy closely combines two aspects that we will now discuss in turn: the growing importance of knowledge and its dissemination using new information and communication technologies (ICTs), and their partial privatisation.

Knowledge as an essential resource

According to A. Janneh (2007), UNECA Executive Secretary, the current global society is driven by information and is characterised by knowledge-intensive industries and services, comparative advantage, and economic success being increasingly based on the effective utilisation of intangible assets such as knowledge, skills and innovative potential. Africa risks losing a high percentage of its human resource through a brain drain to countries where the knowledge industry is more developed. Although it is accepted that knowledge plays an essential role in success and that the brain drain is real, this statement has two flaws:

- It is far from certain that knowledge is playing a more important role than before. The industrial revolution in Europe and North America was based on the Enlightenment, rationalism from Descartes to Kant, and scientific creativity in the 19th and 20th centuries.
- Referring only to industries and services in the dynamic of global society masks the essential role played by public services of all kinds, in particular by public education, university, public research, libraries and other public systems of information and culture, which actually absorb most of the exodus of African minds.

According to Amable and Askenazy (2005), the recent attention paid to the knowledge economy stems from the growing importance of research and education activities in the global economy. This rise in knowledge-intensiveness also concerns the associated ICTs. But it would take boundless technological optimism to conclude that the dissemination of these technologies can help South countries to catch up with those in the north. The dissemination of these techniques can only be considered as a complement to organisational, cultural and behavioural changes, and, in particular, to the improvement of individuals' skills. One of these elements, transplanted into a different context, is not in itself enough to trigger a virtuous dynamic.

The articulation or interconnection of the physical, technical, social, cultural and even psychological aspects highlights the need for a systemic approach. The idea is not for each person to be competent in everything, but, on the one hand, for each person, at least in the knowledge-rich sphere, to have a wide and multi-disciplinary scientific culture, and, on the other hand, for a problem to be analysed with a range of approaches that cover the various aspects of the system.

This leads us to reflect on knowledge and how it is disseminated.

Knowledge is a good that is hard to control, unrivalled and cumulative (Vincente, 2003). The first regime for incentivising knowledge creation is creating a market to restore private initiative. It aims to restrict access to knowledge by granting temporary exclusive rights to new knowledge. The second regime is public: open knowledge, with the circulation of codified knowledge, practical knowledge, and research instruments. The world of closed knowledge is a semi-

permeable world that makes cooperation difficult. The idea of closed knowledge is closely associated with intellectual-property rights (copyright and patent rights). Policies that help to weaken open-science institutions may prove counter-productive in the long term.

It is obviously important to encourage the use of new ICTs in order to reduce the digital divide within African countries and between Africa and other regions, but especially because it is an extraordinary vehicle for exchange, culture, education and information, and therefore for accessing and disseminating knowledge. Nevertheless, it is advisable for each exchange platform to have a clear vision of its target audience. Researchers, businesspeople and the general public seek different information with various degrees of specialisation. These instruments should be initiated, and most of all administered, by Africans so that they reflect African concerns.

But it is just as important to conduct an intellectual-property policy in favour of open science, by excluding life and knowledge from the scope of patents, and by transitioning scientific journals into publications based on open access, creative commons, etc. Note that the shamans of 20 Indian tribes in Brazil, meeting in early December 2002 in São Luis, wrote very officially to the World Intellectual Property Organization with the backing of the Brazilian government to protest against the fact that their traditional knowledge – often related to the sacred domain – could be patented (Barthélémy, 2002).

However, according to A. Ouédraogo (UNECA, 2007: 5) of the International Labour Organisation (ILO), the knowledge economy is skills- and gender-biased and tends to generate income inequalities and unbalanced access to opportunities. Technoscience is indeed still male-dominated, unlike the humanities and human sciences.

Knowledge privatisation and competition

On the basis of democratising information – which, in itself, is legitimate – a more questionable approach is often made official: that of systematic competition with the other economic powers (Boudet, 2008). The knowledge economy thus tends to format public opinion and institutions according to the dominant criteria of growth and instant profitability; this occurs to the detriment of the services which must nevertheless continue to be dispensed by science, art and culture in order to maintain an acceptable level of social cohesion both at school and in society (Richez *et al.*, 2009). According to Alain Trautmann (2009), the leader of the "Sauvons la recherche" ("Save research") movement, which expresses the concerns of French researchers and plenty of their fellow citizens, this knowledge economy, by systematically linking research and innovation, is increasingly tending to constrict research activity. The knowledge economy promotes useful research with a technological purpose, which eliminates the human and social sciences. The training of the individual and the citizen, and the ability of societies to revitalise and redefine themselves, are thus severely unbalanced, benefiting growth with no prospect of the sustainable development of civilisation (Boudet, 2008).

Amable and Askenazy (2005) thus warn against the normative aspect associated with the knowledge economy: a reform of institutions and organisational modes accompanying a new age of capitalism that is supposed to be characterised by intensified competition, by precarity and by the requirement of flexibility. Some of these elements are a myth; others are orienting societies towards a single model of capitalism under cover of technological determinism or of the need for modernity.

Knowledge is henceforth understood to be marketable only, a privatised factor or private growth; an object of trade: Instructive in this respect is the definition of the digital economy ("e-finance, e-transactions, e-commerce, e-trade and e-content, e-legislation") in UNECA (2009: 3). The primary objective is the commercialisation of science, knowledge and life, followed by researchers being urged to be "competitive". The socio-cultural and institutional environment is thus becoming ever less conducive to basic or societal research and to knowledge that is hard to commercialise.

Trade, communication and business methods are now used to manage, and even produce, knowledge. This was epitomized by the holding of an "idea factory" at the UN "Science with Africa" conference in March 2008 in Addis Ababa: a sort of multi-session brainstorm, during which hundreds of participants launched thousands of ideas, from which a committee of unknown consultants extracted 20. This big bar-room discussion ignored the fact that the difficult thing is not to produce ideas or even to select the best ones, but to produce original and potentially productive ideas. It will subsequently be necessary to convince the community that they are good ideas, because the most original and doubtless most productive ideas are precisely the most vulnerable to all sorts of criticism and which meet with the most resistance. Original ideas are vulnerable because new: they are not yet well developed enough to be understood. It is therefore hard to defend them, because the arguments in their favour have not been fully constructed. This is why original ideas are often the most difficult to win approval for.

In addition, who has the power and is supposed to choose from among the ideas put forward, to decide which are admissible and which are not? This is a strategic activity for the African society in question. It requires highly-cultured people with very open minds. The legitimacy of the people tasked with this job is essential for the selected new ideas to gain social recognition and thus be embraced. In addition, Leach *et al*. (2005) argue that many non-western views of knowledge, as seen in research in development studies, still do not fit with the prevailing view of 'expert knowledge' in the west and thus may not be considered legitimate. And even when scientists reach out for local knowledge, they may lack important skills needed for success.

This method, which occupied the participants for a good part of the conference, is in favour of banality and marketing, far from difficult intellectual production and its scientific rigour, which are essential for "improving capabilities".

There is a need to develop appropriate policy in Africa to develop and apply knowledge based services for marginal people (Stigter, 2006).

4. Research system and its connection with development

At the same conference, with the notable exception of several excellent papers – in particular by the president of the Academy of Sciences for the Developing World (TWAS), the representative of UNESCO, and a member of the European Research Foundation (ESF) – there was no analysis of the social and economic conditions of research, of scientific activity, or of the transfer of knowledge and know-how: analysis of scientific staff and of the conditions in which they work; of the fields they cover; of the conditions of success, etc. The human and social sciences were curiously absent, as if their development were only a matter of techniques and not, firstly, of human resource.

We feel it is essential to understand the conditions of scientific production and the environment that promotes it, for the three types of research presented above – basic research, experimental development, and societal research – while investigating in depth the relationships between research, knowledge and development. Development cannot be a blind process or one led in accordance with a simplistic ideology that matches the standards of the current developed countries. The exclusive focus on companies implies that a country's development derives quasi-exclusively from the development of private-sector companies. This forgets the equally fundamental role of public services (water, electricity, transport, health, culture, education, etc.), without which solid development is not possible.

The contribution of all scientific activities to Africa's development should be studied. In particular, it would be advisable not to focus on specific aspects to the detriment of a holistic, balanced view. For example, questions must be asked about the role and boundaries of ICTs and of the geosciences in research, technological innovation, and lastly development. This analysis

cannot be done only by the professionals and operators in these domains, who are both judges and judged.

Ultimately, a society cannot revitalise without analysing its actions (or inaction), its experiences, and the conditions of its past failures and successes. By this we mean a deep and rigorous analysis, and not a sub-ideology of marketing: here, human and social sciences research has a key role to play. In activities to do with information, science and technology, great importance should be given to the human and social sciences and not just to engineering sciences – and, indeed, to life sciences. Only human and social sciences can address questions such as: what are the decision-making processes? How is a transport system organised? What are the different economic systems in farming? What are the cultural barriers to innovation? Which cultural resources promote innovation and development? Which elements of traditional knowledge and know-how are liable to be factors of development? In development, what are the respective roles of the market, public services, and the informal sector? What role do international relations play in development? Which elements of governance accelerate or impede development?

5. Producing knowledge locally

The analysis of conditions of knowledge and know-how production obviously complements production itself. But political decision-makers need fast answers to their questions (projects, plans, policies, etc.). When national research has not been developed, as is the case in many South countries, there is no training through research or, consequently, emergence of local skills, including in research firms. Neither national research nor consultants in the South can therefore provide a general response to these questions.

The decision-makers will then use consultants or researchers from developed countries. Those unversed in local realities, and lacking the time or resources to become properly acquainted therewith, propose solutions that are formally good but with content based on their knowledge and culture, in a kind of copy-and-paste approach. Most often, these solutions are inadequate in substance because their execution is problematic owing to an unsuitable socio-cultural environment. Through regulatory or advertising pressure, they can provide an acceptable short-term response, but it will not be sustainable.

The response to this is definitely investment in local research, and firstly by more highly valuing local researchers and giving them recognition.

The objective of research, however, must not be responding to the questions of political decision-makers. The link is more complex: research activity creates knowledge and know-how, promotes local skills, and thus increases the scientific skills of society, which enables local consultants to respond directly and properly to decision-makers' requests. An essential prerequisite for research is independence.

The research independence allows detachment from official data and from local knowledge and know-how, which, as far as possible, must be questioned before being validated. Independence is primarily necessary because research is not guided by a policy of narrow and short-term objectives. Electricity and the electric bulb were not discovered while improving the candle! The results of research are generally unexpected. This is true of basic research, but also to a great degree for societal research, which is far more productive than the simple question that drove it. Only experimental development is wholly guided by a precise objective, using existing knowledge.

But because small resources, it must be optimised and approach-sharing must be maximised. Collaborative research between researchers and universities is the most productive, and though it is promoted in policy messages, it is made very difficult by research conditions. Real backing should be given to researcher networks by eliminating obstacles in terms of regulation,

management, finance and personal careers so that collaborative research is genuinely encouraged, particularly among South countries themselves. Researchers and sector professionals must therefore initiate and take part in specialist networks, which for a relatively small cost set up excellent ways of optimising research resources, notably through coordination, efficient exchange and training schemes, and the dissemination of knowledge and findings. This can be networks at every level, from regional to international. The pooling of knowledge, tools, methods and solutions is necessary, but must always be adapted to the context of the considered country or region.

6. Programme to strengthen research-developing capabilities in Africa

Africa needs the international community's support to strengthen its capability to develop its research. The United Nations, convinced that Africa needs medium- and long-term scientific research for its development, can develop a support programme in synergy with the other ongoing programmes, to support the development of research in Africa. The United Nations University, UNESCO, the UNDP and other UN organisations can make an effective contribution to an integrated programme by leveraging their experience in these countries, in order to support the development of research in the various disciplines of interest by country and by region: intangible support for research (excluding facilities), facilitation of exchanges, joint projects, and the dissemination of skills and findings. The programme could revolve around the following:

A. Strengthen the self-confidence of African researchers

- Improve institutional recognition of African researchers (pay, consideration), which would help keep brains in Africa;
- Promote researchers' intellectual fulfilment by trusting their creative abilities, which would promote the emergence of African thinkers who would drive Africa upwards;
- Promote African researchers' mobility, so that they can leave and then be able to come back;
- Encourage African expatriates to take part in the development of research in their country of origin;
- Host foreign students, especially from the North, in universities and research teams;
- Set up research projects on a North-South cooperation basis;
- Fund the hosting of North researchers for short assignments in African research teams;
- Encourage the authoring in Africa of dissertations on topics of African interest, co-directed by parties from North and South;
- Publish articles co-authored by researchers from North and South;
- Summarise and publicise successful experiments conducted in Africa.

B. Build an African research community

In order to promote knowledge and know-how transfer between southern countries:

- Promote encounters with African researchers by holding conferences and seminars in Africa and by giving logistical support to participants;
- Encourage the creation of bi- or multi-lateral, mono- or multi-disciplinary African research teams, by promoting the set-up of research cooperation projects;
- Facilitate the physical mobility of researchers in Africa by lifting regulatory and logistical barriers, especially for transport;
- Train researchers and students in research tools (software, hardware) and primarily in the specific methods of research: invest in people rather than equipment.

C. Cover the different forms of research

- Provide equal support to the different forms of research: basic research, experimental development, societal research;
- Draw on the knowledge and know-how transmission needs of the various tiers of African society in order to supply societal research;
- Take a holistic, mid- to long-term approach to research; and
- Promote multi-disciplinary research (engineering sciences, life sciences, human and social sciences).

D. Strengthen research-management institutions

- Improve the capabilities of research-management staff by training them in this specific activity, using workshops and seminars on research.

E. Disseminate knowledge

- Encourage and facilitate the publication and dissemination of the findings of research done in Africa;
- Support and encourage the development of online African science journals on an open-access basis.

This detailed proposal needs to be discussed and developed further. It could draw inspiration from the experience of the COST initiative[2]. Since 1971, this inter-governmental initiative has aimed to increase cooperation and interaction between researchers in nine scientific domains that cover most of the field. COST is organised by single cooperation "actions" on a given topic, with a limited number of researchers from at least five countries, for a period of three to four years. For example, COST funds participation in action-coordination meetings, inter-laboratory researcher exchanges lasting one to six months, training schools, seminars and, lastly, the dissemination of findings in the form of dedicated reports, conferences and websites. The initiative is open to non-European countries and particularly to Mediterranean-basin countries. Support from COST or another European source can certainly be envisaged for an African capability-strengthening programme.

The first stage could be to set up a pilot project of cooperation in a specific domain.

7. Conclusion

It is hard to manage the scientific activities efficiently with the aim of development when their characteristics are not known. One must define the outlines and activities of research and innovation: what are their objectives, methods and roles? How are they different and complementary? In what conditions are they conducted? Who are the stakeholders and participants?

We argue that in addition to the three types of conventionally recognised research - basic research, applied research and experimental development, we have to add the targeted societal research for decision-making, which introduces a major stakeholder, the society as a whole.

The discussion of these different research types indicates that the relevant contrast appears to be less between basic research and experimental development than between commercial or market-driven research and public-service research not mediated by the market. The open knowledge plays here a fundamental role in the evolution of the societies and in their development.

The concept or ideology of knowledge economy favours nevertheless instant profitability and constricts research activity, by promoting useful research with a technological purpose, which makes very marginal basic research, societal research, human and social sciences, and all what could allow the citizens as the societies to revitalise and redefine themselves. The exclusive focus on companies implies that a country's development derives quasi-exclusively from the development of private-sector companies. This forgets the equally fundamental role of public services, without which solid development is not possible, nor even technological development.

The knowledge economy appears thus opposed to knowledge creation, although this new knowledge in exact or social sciences is absolutely needed by each of us and each society to answer the present challenges.

Notes

[1] Committee on Development Information, Science and Technology of UNECA, Addis Ababa, 28 April – 1 May 2009. Available at: www.uneca.org/codist/codist1.asp

[2] European Cooperation in Science and Technology, Available at: www.cost.esf.org

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