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Full Length Research Paper

Changing African scientific research approach in the 21st century

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The scientific research environments in industrialized and non-industrialized countries are compared, mainly as far as supportive industries and services to agricultural producers are concerned. Further environmental deterioration and alienating poverty are often a consequence of the observed absence of focused assistance. It is then discussed why and how Africa should change its scientific research and develop its own approach. This asks for new scientific research policies in Africa. The central thesis of this paper is that as agricultural scientists we have come closer than ever to farmers, but we are farther away than ever from policy makers. A simple conceptual and diagnostic framework is discussed by which this situation in scientific research can be easily explained. TTMI- Project results on agrometeorological services in Sudan are discussed in that new context. The paper concludes with first wording in this same new context the final implications for the change in scientific research approach needed in Africa, including a short comparison of research on health services with those on agricultural services. Finally, such implications are discussed the same way for higher education in Africa, also again referring to another important recent development, that of diagnostic studies, that is used as reference throughout this paper.

Keywords: Africa; agricultural services; agrometeorology; higher education; livelihood of farmers; policy environments; scientific research; research approach.

INTRODUCTION

From his African experience, the author came to believe long ago that in developing countries, basic and applied sciences have to be taught but very operational applied sciences have to be practised in research (Stigter, 1982). Scientific research can be distinguished in many applied fields: agriculture, health, resource exploitation, industry,

*Invited lecture as founding president of the INSAM (www.agrometeorology.org) for the Open University of Sudan at the Institute for Studies of the Future, Khartoum, on 23 April 2005. On 26 April the same lecture was presented at the University of Gezira, Wad Medani, Sudan, where the author is an occasional visiting professor since 1985. Parts of this material had been presented on 14 April in a farewell lecture at the Chairgroup of Meteorology and Air Quality, WUR, under the title: "No policies, no cure: why the marginal farmers that need our agrometeorological support most are nowhere getting it".

"gamma" sciences. The approach outlined in this paper is valid for all but will be illustrated for agriculture and health.

Level and scale of basic and applied research and the use that is made of their results, obtained locally or elsewhere, greatly differ between countries (Mettrick, 1993). They particularly differ between industrialized and non-industrialized countries. In highly organized countries, direct contacts or various relatively well-organized channels exist, for example between farmers and those in agriculture related supportive industries and services, along which information is exchanged or at least can flow (Stigter, 2005).

Public institutions, interest groups and private initiatives on a commercial basis stimulate this in “stronger” countries. Intentionally enabling public institutions and biased global markets make well-organized producers, which use available or new knowledge, survive in such countries (Stigter, 2005). History shows that for example farming was able to cope with painful adaptations to changes, because of these institutions and conditions

(Bonte-Friedheim and Sheridan, 1997). The prizes paid for safeguarded food security and food safety were permanent transformations of the agricultural professions, in which many farmers lost their means of existence, while the resource base is endangered in many ways in many places.

In developing countries (long ago also called “soft states”) public institutions are seldom sufficiently helpful, rarely sufficiently organized and often not intentionally enabling its own officers or others to meaningfully support producers in decision making and in improving and protecting products and the resource base; while markets are not conducive to production improvements (Abdulai and Hazell, 1995; Sachs, 2005). To a large extent only richer people are able to make use of whatever support systems are organized, while the majority of marginal people are left in misery (Jazairy et al., 1992; Sachs, 2005; Stigter et al., 2005a).

Moreover, at best only very modest structures are in place that can deliver suitable information, or use existing information, to create appropriate services (Olufayo et al., 1998; Stigter et al., 2000; NJAS, 2004). Further environmental deterioration and alienating poverty are often a consequence of that absence of focused assistance (Galbraith as narrated in Parker, 2005); because traditional knowledge and indigenous technology can often no longer cope with the dynamics of environmental and other changes (Reijntjes et al., 1992; Stigter et al., 2005b). An illustrative specific example from Sudan is given in Bakheit et al. (2001).

Scientific research in Africa in this century will have to fully realize the above context. At the same time it will have to contribute to changing that context. This demands also a different approach to higher education in Africa (Mungai et al., 1996; Stigter et al., 1998; NJAS, 2004). Africanized science for African people.

In Africa the author learned over the past 25 years that science and technology are just one corner stone to fight poverty, empower people and enhance people’s dignity through life long education (Stigter, 2005). In Africa we proved in the course of time that in agricultural science quantification to understand (and design relief for) the problems of traditional production may help, as among others abundantly exemplified in Baldy and Stigter (1997). The second corner stone therefore is an understanding of local adaptive strategies and innovations (Stigter, 2005). In agricultural research, participatory diagnostic support to Low External Input Sustainable Agriculture (LEISA) is the only approach that might be able to reach the marginal farmers of this world (Reijntjes et al., 1992; Röling et al., 2004; Taba et al., 2004; Stigter et al., 2005b). Scientific research must adapt (Stigter, 1999; Ayenor et al., 2004; Nederlof et al., 2004; Stigter et al., 2005c) and so must its education (Stigter et al., 1998; NJAS, 2004).

In Africa this asks for new scientific research policies. Indeed “policies” (and “projects” feeding such “policies”) are forming the third corner stone (Stigter, 2005). In agricultural research this approach is called “development of research based agricultural services”. The fourth corner stone are the people themselves, the producers and workers. It is put forward here that together with education, health is a most serious limit in their livelihood. But for “health services” applies the same absence of policies that serve marginal people (Stigter et al., 2005a).

Before we bring the above in a simple diagnostic and conceptual framework developed and tested over the past years, policies should be discussed. There are no appropriate policy environments in Africa for development and application of knowledge based services for marginal people. This applies to local grass roots policies concerning decision makers in Third World countries, to international policies of all kinds but also to national policies. As agricultural scientists we have come closer than ever to farmers (Bakheit and Stigter, 2004; Röling et al., 2004; Ayenor et al., 2004; Stigter et al., 2005a) but we are farther away than ever from policy makers (Onyewotu et al., 2003). That is the central thesis of this paper.

Policies have to be designed and carried out that support such participatory development and application of knowledge based services to marginal people (Stigter, 2003; Nederlof et al., 2004). This is where scientific research in Africa in this century has to change its approach. It cannot be the same as usual. Scientists in their daily practice need to help in preparing new policies of all kinds and to assist to carry out what services have been decided on.

METHODOLOGY

A diagnostic framework will now be discussed that simply expresses what was derived above. Development of this new approach as far as applied agrometeorology is concerned has been reviewed in Stigter (2006a).

In Figure 1 three domains are distinguished. The A-domain is that of the livelihood of farmers, where agricultural information should be applied and agricultural services should be provided. The C-domain contains the support systems to any application activities. Such support systems may be distinguishes as “data”, “basic research”, “education/training/extension” and “policies”. Between these domains we have plotted the B-domain, where the initial conditions and the boundary conditions for solving problems of agricultural production in the A-domain are defined. Its three components are three fields of knowledge and understanding where insufficient preparedness exists for the present demands for solving new and worsened problems.

Good intentions of scientists have for example made agricultural and health sciences more operational and have led to what may be called “action support systems", for example on mitigating impacts of disasters (E1). Examples in agrometeorology are monitoring systems, early warning systems, weather and climate forecasts as well as other meteorological products made available by weather bureaus and other message providers, general weather advisories, maps of all kinds on various issues, focused quantitative models, developed methods in search of problems. In other fields of agricultural science similar examples can easily be given.

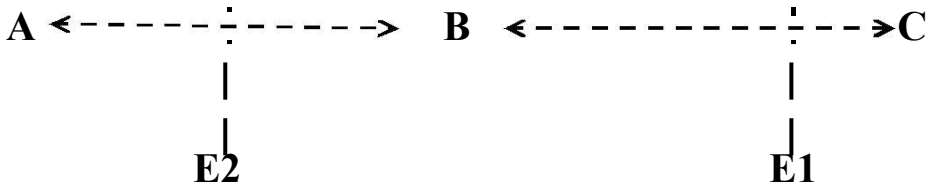

Figure 1. Stigter's "end to end" information generation and flow scheme with the A, B and C domains
E1 = Action Support Systems, E2 = Services Supporting People as Producers and Citizens.
A = Sustainable livelihood systems
B = Local adaptive strategies (knowledge pools based on traditional knowledge and indigenous technologies)
+ Contemporary knowledge pools (based on science and technology)
+ Appropriate policy environments (based on social concerns and environmental considerations, scientifically supported and operating through the market where appropriate)
C = Support systems to services: data + research + education/training/extension + policies

However, in Africa they appear almost everywhere to be insufficient to make a difference in the livelihood of farmers (NJAS, 2004; Sachs, 2005). They have not led to a sufficient increase in operationability of science, working explicitly in the domain of the livelihood of farmers and in the conditional B-domain, away from the C-domain of support systems. For new demands due to changing global and local conditions we are even less prepared to use the four corner stones of agricultural services as earlier defined (Stigter et al., 2005b).

RESULTS

A case study

The above analysis has everywhere it was presented been much debated but also much appreciated. This was definitely even more the case because we have everywhere added examples of our African TTMI-Project, to show that we practised what we preached. They show successes, failures and local limitations of the required approaches in the B- and A-domains in the African realities of the four countries concerned (Stigter et al., 2005d). We therefore deal here shortly with the local TTMI case studies for Sudan. The first case was on "Traditional protection by trees of parts of the Gezira scheme from drifting sand", an example of immediate disaster prevention. This led to the development as (agrometeorological) service of design rules of shelterbelts for combating sand invasion that were subsequently applied in extension policies for these belts (Mohammed et al., 1996). It also led to understanding of extreme difficulties in tree establishment under conditions of serious desertification and to understanding of what natural generation or even well guided grazing practices by marginal desert dwellers is able to achieve under the highly variable conditions of the local soils and climate (Al-amin et al., 2005).

Another case was on (agrometeorological) services with "Underground storage of sorghum in improved matmuras", where in a participatory approach shallower pits were designed; with the use of local insulation materials between grain and soil and with above soil precautions for preventing water to be guided to the pits by cracks (Abdalla et al, 2002). In Sennar State, Central Sudan, local innovations were at the base of these designs, as should be the case in appropriate use of the B-domain. Explicit government policies were guiding some research (Abdalla et al., 2002) but policies were completely lacking in extension and in dissemination of results (Bakheit and Stigter, 2004).

Finally, for Sudan, our work in quantification of water waste in the Gezira irrigation scheme when using newer, less labor intensive irrigation methods on dura (sorghum) and groundnut in comparison to traditional modes of irrigation, again could be pertinent on design issues (Ibrahim et al., 2000). The results were particularly of support as (agrometeorological) services to the development of local water use efficiency policies (Ibrahim et al., 2002).

In all these cases, methodological sampling issues and other issues of quantification under tropical conditions got ample attention, because such measurements were and are only rarely done in Africa or never at all. The scientific input always extended the use of science to issues specific to the tropics under the inhomogeneous conditions of small farmers' fields.

DISCUSSION

Scientists alone can't change the world but it is helpful to have a good diagnosis of how basic and applied research are conceptually related to decision making by marginal farmers and how in Africa they are actually little related to such decisions (NJAS, 2004). This will at least make understandable why scientific research has failed, and it might give a clue where bottlenecks could be tackled to improve the development and availability of services to the more marginal farmers in a new approach (Stigter, 2006a; 2006b).

The B-domain is the "Bow Bridge" of the gap between science and the livelihood of farmers, of which bridge one guiding ramp, departing from science (E1), has been well developed. However, the guiding ramp getting up from

the livelihood of farmers was left unfinished. The available products hang in the air and are not confronted with reality and adapted along that part of the bridge.

Producers and citizens in Africa do therefore not get any benefits out of research based services that should address people's needs. For E2 guidance we have to go from the B- to the A-domain.

Let us now borrow illustrative examples from health research. A recent meeting of health ministers took place in Mexico on funding of such research (Associated Press, 2004). Three points the meeting made are selected for which parallels are drawn with agricultural research, using the framework developed. The meeting among others stated that simply targeting serious diseases such as aids/HIV as well as malaria for more study and research (E1 guidance in the framework) would not slow increased death rates from those illnesses in the developing world. In agriculture you may replace these most terrible diseases with the most terrible disasters: droughts, floods, cyclones. More research related to agricultural aspects of these calamities will not slow down the death rates and damages, better participatory preparedness research will (Stigter, 2006a).

The meeting of health ministers also concluded that what should get priority was reducing health services related inequalities and preparing better access to already existing services (E2 guidance in the framework), but now for the poor. These are policy matters (B- domain) that should come first. The same applies to getting already existing research results and information as agricultural services to marginal farmers.

Another important proposal was to put public health decisions for marginal people in the hands of better-informed officials who are able to work on a community level (A-domain), to more efficiently implement policies and findings. This is very much related to policies on the training of intermediaries between the products selected from the E1 offerings, and made client friendly using science operationally in the B-domain, and the livelihood of farmers (A-domain). Intermediaries that were proposed to guide the establishment and application of agricultural services (E2 guidance).

These examples show that services for marginal people in all fields that touch their living standards are meeting comparable problems (see also for a recent Asian case Stigter, 2006b). Africa could learn from these Latin American and Asian experiences, the way they can learn from Africa.

National Universities in Africa should be places where science can be applied to understand reality and motivate people to solve their problems (see for agriculture Stigter et al., 2000; NJAS, 2004; Stigter et al., 2005d). However, the tasks of the needed scientific research must be recognized, prioritized and acknowledged (Mungai et al., 1996; Röling in Beek et al., 1997). Our experiences in the TTMI-Project were reviewed in this context (Stigter and Ng'ang'a, 2001; Stigter, 2001).

I have argued with others many times that for too long, non-industrialized/southern countries have been tied to and have been imitating research (and educational) systems and their underlying values from industrialized western/northern countries, which are alien to their rural cultures (Stigter et al., 1998).

Classical quality training in agriculture takes place in the C-domain, also in Africa. There is a large need for policies developing explicit local education and training, at all levels of applied science, in the services and extension focused B- and A-domains. This would indeed be a new approach if in Africa the results would be worked back as case studies into the classical education of the C-domain. The C-domain could that way become better focused on the support needed in the problem derived operational use of science that is necessary for actual work in the A-domain. Also here, in education, we should aim at bridging the gap in Africa.

Such an approach demands policy changes in the classical education and training in Africa. Making students and trainees much more aware of application needs and actual applications of services developed with the methodologies they learn so much about. The Diagnostic Studies approach (NJAS, 2004) and the TTMI/African Network approach (Mungai et al., 1996; Stigter and Ng'ang'a, 2001;Stigter et al., 2005c) as argued above are unique examples of bringing such thinking into practice.

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