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TANZANIA

by
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About the Author

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First trained as an engineer in agriculture, he is a doctor in sociology specializing in science policies and the sociology of the scientists. He published in all fields of the science studies (including indicators and evaluation). He has authored about one hundred articles and several books, among which, recently, “Scientific Communities in the Developing World (with R. Waast and V.V. Krishna) and “La coopération scientifique et technique avec les pays du Sud".

Contents

INTRODUCTION

This report was prepared following a mission by Jacques Gaillard to Tanzania in February 1999[1] during which visits and interviews were made in Arusha, Dar es Salaam, Morogoro, Mpwapwa and Zanzibar in a variety of institutions specialized mainly in the biological and agricultural sciences, as well as to a lesser extent nutrition and health. The lists of the institutions visited and scientists interviewed by Jacques Gaillard are given in appendix.

Additional interviews were conducted by Xavier Ricard in July 2000 for the field of social sciences mainly at the University of Dar es Salaam (USDM). More interviews in the field of medical sciences were also conducted by Zahira Belhocine in November 2000. Due to time constraint and (non)availability of transcribed interviews at the time the report was written, it was not possible to take the latter interviews into account.

1- OVERVIEW OF NATIONAL S&T ACTIVITIES

Given the high level of foreign aid that Tanzania received over the last 30 years and notably from the Scandinavian countries since the end of the 1970s, a lot of documents (study visits, reviews, evaluations, consultancy reports) have been prepared on the development of Tanzania including S&T activities. Among the documents perused, recent reports prepared for NORAD and Sida-SAREC (Widstrand, 1992 and 1996; NORAD, 1999) as well as by COSTECH (1998) were used to write this section. They were particularly useful for mapping the institutional research situation, presenting the main research areas, and assessing the strengths and weaknesses of the Tanzanian national scientific system.

1.1- Research coordination and policy

The first national body for science and research to be established in Tanzania was The Tanzanian National Science Research Council (UTAFITI) in 1968[2]. Its mandate was rather limited and not very well defined. In particular, it neither included the supervision and coordination of research activities with the national universities and research institutes, nor any advisory role. In 1986, UTAFITI was transformed into the Tanzanian Commission for Science and Technology (COSTECH). It started to work in 1988. As stated in the Parliamentary Act, COSTECH should have both an advisory and a policy-making role. A completely new and impressive building has been erected in the early 1990s outside Dar es Salaam on the Bagamoyo road to accommodate its staff and headquarters[3]. COSTECH developed a document on priority areas for research in Tanzania which was recently re-examined (COSTECH, 1998). These areas cover a wide range of research topics including agriculture and livestock, natural resources, environment, medicine and public health, industry and energy, basic sciences and finally social sciences. Research topics listed tend to be more focused on short term applied research projects than long term research projects of a more basic nature. The work of the Commission is carried out in four directorates out of

[1] 1-17 February 1999. The first part of the stay was however spent attending a meeting of the Association of African Universities in Arusha.

[2] Tanzania was one of first African countries to establish a national research council as recommended by UNESCO in the 1960s.

[3] In January 1999, 87 staff members (of which 27 are professionals) were working for its secretariat.

which the Directorate of Research Co-ordination and Promotion[4] is probably the most relevant for our study.[5] Among recent noteworthy activities, COSTECH is developing an electronic communication network to link Tanzanian R&D institutions between themselves and with the rest of the world. This also involves the organisation of training seminars. But due to budgetary constraints, these training activities remain rather limited. The Commission has also established a National Fund for the Advancement of Science and Technology (NFAST) in 1995 to allocate research grants mainly to individuals to support research and technology projects in Tanzania (COSTECH, 1996)[6]. Again, because of severe budgetary constraints, NFAST granting activities, like many of the activities planned by COSTECH, are very partially financed or even not implemented at all[7].

Table 1 *:* Main research (and higher education) policy bodies

Institutions	Main tasks/responsibilities
The planning Commission of the President's Office	Co-ordinates national and sectorial policies and plans
Ministry of Science, Technology and Higher Education (MSTHE)	Responsible for the operation of Tanzania's three universities, 14 technical training centers and COSTECH
Sectorial ministries (with research departments, policies, plans and research institutes)	e.g. Agriculture and Health. Coordinate research activities in line with national plans and priorities
Higher Education Council	Established in 1994 with main objec-tives to coordinate the development and planning of higher education
COSTECH	Co-ordination, research funding, national policy making (?) Responsible for 19 affiliated national institutes

Source: adapted from NORAD (1999)

Following the establishment of COSTECH, the Tanzanian research superstructure has been completed by the creation of a Ministry of Science, Technology and Higher Education (MSTHE) in 1992. Normally, the Ministry should be responsible for the overall policy making role whereas COSTECH should act as a coordinating body being also in charge of making and revising the national research agenda. Such a division of labour would require a strong working relationship between COSTECH and its "mother ministry". This however does not seem to be the case today. The main relationship today is that MSTHE is directly financing COSTECH's administrative expenses (staff salaries, running expenses, etc.). While the two core bodies for research policy and coordination are MSTHE and COSTECH, other institutions are also involved as policy bodies for research and higher education (see table 1 above).

[4] The other directorates include: the Directorate of Technology Development (recently renamed Center for technology development and transfer), The Directorate of Information and Documentation, and the Directorate of Finance and Administration.

[5] The acting Director for the Directorate of Research Coordination and Promotion in 1999 is Mr. Issa Munisi.

[6] This fund which operates according to procedures very similar to the IFS but at the national level and with slightly smaller size grants (approx. USD 5000). It is co-funded by Danida.

[7] Most recent grants recommended by NFAST were not recommended for support due to lack of funds (for more detailed information see point 6 below).

1.2- Research and higher education institutions

As shown above for the research policy bodies, the Tanzanian system of research and higher education institutions is diverse. The recent mushrooming of new private and non-governmental organisations has added some confusion to the institutional landscape, which is overall somewhat lacking coherence and co-ordination.

1.2.1- Universities

The first university to be established in Tanzania was the University College in Tanganyika[8] in 1960 one year prior to the Independence. It was initially affiliated to the University of London. In 1962, it became a constituent of the University of East Africa together with Makerere University College (in Uganda) and the Nairobi University College (in Kenya), until 1970 when the University of East Africa was dissolved[9]. It then became the University of Dar es Salaam. The first students were enrolled in the Faculty of law. More Faculties were added during the 1960s including Science (1965), Arts and Social Sciences (1967), Medicine (1968) and Agriculture at Morogoro (1970).

Today, there are three public universities in Tanzania: The University of Dar es Salaam (UDSM), Sokoine University of Agriculture (SUA) and the Open University of Tanzania (OUT). So far, the latter is the only university south of the Sahara to offer degree courses through distance learning. UDSM and SUA, the two main public universities, are briefly presented below.

A general feature of the public universities is the lack of financial resources which results in under-paid staff, sharp reduction in the number of scholarships, overcrowded and deteriorating facilities, marginal activities in the field of research and insufficient science equipment. Another important characteristic is the ageing of the academic staff population. No recruitments took place in the public sector over the last 7-8 years following the implementation of the structural adjustment programmes. In the two main public universities (UDSM and SUA), not a single staff member was under 30 years old in 1998 with the bulk of the population being between 40 and 50 years old (see table 3 below). If no new recruitment policy is implemented, the reproduction of this ageing national scientific community will be seriously threatened.

Table 2 :Average age profile of academic staff in Tanzania in 1998

Age	UDSM – SUA %
Less than 30	-
30-39	16,4
40-50	74,6
More than 50	9,0

Due to the lack of scholarships for postgraduate degrees and the prevailing terms of employment, academic degrees are awarded at a relatively rather advanced age. On average, a

[8] Tanganyika is the continental part of today's Tanzania. In 1964, Tanganyika merges with Zanzibar to become Tanzania.

[9] Today, there is a renewed interest in reviving the former cooperation within Higher Education and Research within the East African Countries and also witin the wider SADC region.

BSc degree is obtained at 28, a MSc degree at 33 and a PhD at 42. It is in fact rather common to meet Tanzanian scientists finishing their PhD training in their late 40's or early 50's.

A recent development is the proliferation of private universities whose establishment is encouraged by the Government on the condition that they meet the same criteria as public universities. Given the high fees requested, few Tanzanian students can afford to register in these private universities. Due to higher salaries and better working conditions, these newly established private universities tend to attract academic staff from the public sector, and consequently to further deteriorate an already weak public university sector.

Table 3 :Higher Education Institutions

Public universities	-The Universities of Dar es Salaam (UDSM) -Sokoine University of Agriculture (SUA) -The Open University of Tanzania (OUT)
Private universities	19 applications for registration of new universities are currently being reviewed by the Higher Accreditation Council, which stipulates the conditions which must be met before a university can be registered.
Other post-secondary institutions	There are many such institutions mainly under the Ministry of Health, Agriculture and Education. The quality of teaching and research activities varies considerably.

With an estimated 2,000 graduates coming out of Universities for an estimated total population of 30 million, Tanzania lags far behind many countries in the region with a ratio of seven graduates per 100,000 people. South Africa is leading the region with 244 graduates per 100,000 people followed by Namibia (140), Swaziland (64), Kenya (41) and Botswana (40)[10]. The situation in Tanzania sharply contrasts with that of Kenya, which has roughly similar demographic and resource characteristics. While Kenya has a university student population of about 40,000, Tanzania has a combined university student population of 4,500 in her three public universities[11]. As a further contrast, for instance, student enrolment at the University of Dar es Salaam fell by 16.5% between 1980 and 1990, when in the same period, student enrolment has increased by 33% in Zimbabwe, 45% in Burundi and 208% in Kenya (URT, 1998).

The University of Dar es Salaam (UDSM)

Today, the UDSM main campus has six Faculties: Arts and Social Sciences, Commerce and Management, Education, Engineering, Law, and Science. Five research and development institutes are also part of the research and graduate studies system of the UDSM: the Institute of Development Studies, the Institute of Kiswahili Research, the Institute of Marine Sciences, the Institute of Production Innovation, and the Institute of Resource

[10] Then follow Lesotho (29), Zimbabwe (29), Zambia (24), Uganda (19), Angola (13), Malawi (12) and Mozambique (10).

[11] The situation in Tanzania is similarly challenged by that of Botswana, with a current university student enrolment of about 3,000, against the country's population of only 1.5 million. Other similarly challenging proportions are presented by Ethiopia, Namibia, and a few other neighbouring countries in Eastern and Southern Africa.

Assessment. The former Faculty of Medicine, which used to be part of UDSM, has been transformed into The Muhimbili University College of Health Sciences (MUCHS) in 1991 which today has an additional four Faculties: Dentistry, Medicine, Nursing and Pharmacy (UDSM, 1998/1999).

The University College of Lands and Architectural Studies (UCLAS), was also established as a constituent College of UDSM in 1996. It was originally founded in 1956 as a Survey Training School. UCLAS comprises one institute (Housing Studies and Building Research), two centres (Continuing Education and Geo-information) and two Faculties:

- the Faculty of Architecture, Quantity Surveying, and Urban and Rural Planning
- the Faculty of Land Surveying, Land Management and Valuation and Environment Engineering

By any standard of comparison the UDSM has a low student enrolment given its present physical facilities and the number of teaching and supporting staff[12]. One of the main objectives of the UDSM Transformation Programme is to expand the undergraduate student enrolment from slightly more than 5,000 today to 8,000 by the year 2,000 and 13,000 by the year 2008. Another challenge for the University is to respond to demands from the productive sector. As long as the University is not in a position to respond to new demands, private alternatives are established. This is the case for specialised training in IT and telecommunications for which private colleges and courses have been established.

In 1997, the UDSM main campus had a core of 584 academic staff[13] out of which 61% were PhD holders (44 full professors, 62 associate professors and 169 senior lecturers). Despite the affirmative policy to promote females into academic positions, women today represent approximately 10% of the academic staff. The university has produced a substantial number of graduates over the years. It is estimated (Sida, 1996) that more than 10,000 undergraduate degrees and 1,633 higher degrees were awarded by UDSM up to 1995. Of the 144 PhD degrees awarded, 17 (or 15%) are women.

Research at UDSM has received marginal funding from the Government during the last ten years. According to UDSM sources, the Government has been allocating about USD 30,000 annually to the UDSM for research activities over the past years, out of a total budget of slightly more than USD 10 million. It corresponds approximately to USD 50 annually by academic staff and 0.3% of the overall university budget. Without support from donors, hardly any research can be conducted at all at UDSM.

The Sokoine University of Agriculture (SUA)

Prior to its establishment as an independent institution in 1984, the Sokoine University of Agriculture (SUA), was organised as a College: the Morogoro Agricultural College established in 1963. The College was integrated as a Faculty in the UDSM in 1970: the Faculty of Agriculture, Forestry and Veterinary Sciences. Today, SUA has three Faculties (Faculties of Agriculture, Forestry, and Veterinary Medicine) and two institutes (the Institute of Continuing Education and the Institute of Development Studies). A new Faculty of Science

[12] A teaching staff of 584 and a student population of about 5126 gives a staff to student ratio 1:8.8 (UDSM, 1999 enrolment figures).

[13] Staff members have numbered fairly constantly around 600 between 1985 and 1990. Staff numbers have started to decrease since then. Given the Government moratorium on employment in the Civil service and in the parastatal sector, retirement, mobility, and mortality, the 1997 figure is likely to be lower today.

is being established at SUA with support from Belgium. It will be organised in five Departments: Biology, Biometry, Mathematics, Physics, and Social Sciences.

In 1998, there were 1308 undergraduate students for 204 staff members. The bulk of the students are to be found in the Faculty of Agriculture (81%), followed by Veterinary Medicine (11%) and Forestry (8%). SUA is planning to increase student intake. The total number of staff holding teaching positions in 1998 was 204 out of which 25 (12%) were women. The number of supporting staff was 614. A major proportion of the teaching staff hold a PhD (72%). Today, women represent approximately 12% of PhD holders and academic staff in general. Yet, there is still a need to provide training and financial support for M.Sc. holders working on their doctorate degrees.

SUA has good links with the Tanzanian Ministry of Agriculture and Cooperatives (MoAC)[14], and COSTECH. At the international level, SUA has developed collaborative links with the CGIAR centres and with some 25 universities in Europe, in the United States and in Africa. Long-standing relations have been developed with the Agricultural University of Norway (NLH). International links are also important with the Flemish universities in Belgium (Antwerp, Ghent, Leuven) and the University of Liège, the Agricultural University of Sweden (SLU), the University of Nottingham in the UK, and Moi University in Kenya to mention only the most important ones. Greater efforts should however be made to create stronger links with major universities in Eastern and most particularly Southern Africa[15].

As a consequence to the implementation of the structural adjustment programme, SUA has been in an unstable financial position for a number of years with Government allocations being recurrently lower than the expected contributions. Donor contributions today represent 50% of the total budget of the University with NORAD being, by far, the major external donor to SUA. It is estimated that Government funding for research at SUA is approximately 1% of the total budget of the University. As an example, in late 1997, 95% of the total budget for 100 research projects being carried out at SUA was funded by 40 donor agencies (NORAD, 1999).

The University Council approved a new strategic plan "Corporate Strategic Plan to the year 2005 and Beyond" in June 1997. It gives a more client oriented role to the University. Special emphasis is put on the need expressed by various user groups (small holders, large-scale farmers, and the agro-industry) and on the need to link research with development issues, environmental concerns and conservation of natural resources. However, although the plan includes a number of basic principles, and major objectives, it seems to fall short of a clear strategy (defining the role of the various user groups and potential clients) and a detailed workplan to implement the new orientations.

1.2.2- Research institutes

Tanzania disposes of a large number of research institutes, that are either affiliated to COSTECH (see Table 4) and/or to the sectorial ministries of which Agriculture and Health are the main ones. We briefly present below the main institutes in these two sectors: Agriculture and Health.

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[14] SUA entered into a Memorandum of understanding with MoAC in 1992 in order to enhance complementarity between the two institutions. The Tanzanian Agricultural Research Plan II (TARP II) covering the period 1998-2002 is likely to further strengthen collaborations between SUA and MoAC.

[15] Except for Moi University in Kenya, and to a lesser extent Makerere University in Uganda and the University of Zimbabwe, major universities in Zambia, Malawi, Kenya, Mozambique and South Africa do not have any collaborative links with SUA.

Table 4 : Institutions affiliated to COSTECH

The National Agricultural Research Council (NARC)
Tanzania Industrial Research Development Organisation (TIRDO)
National Institute of Medical Research (NIMR)
Tanzania Forestry Research Institute (TAFORI)
Tropical Pesticides Research Institute (TPRI)
Tanzania Bureau of Standards (TBS)
Tanzania Industrial Studies and Consulting Organisation (TEMDO)
Uyole Agricultural Research Center (UARC)
Center for Agricultural Mechanisation and Rural Technology (CAMARTEC)
Building Research Units (MRU)
National Construction Council (NCC)
Serengeti Wildlife Research Institute (SWRI)
Tanzania Food and Nutrition Center (TFNC)
Institute of Production Innovations (IPI)
Tanzania National Radiation Commission (TNRC)
Tanzania Automotive Technology Centre (TATC)
National Social Welfare Institute (NSWI)

Agriculture Research

In the recent past, Agricultural research in Tanzania has been subjected to repeated criticisms and subsequent reorganisations. The most frequent criticisms are related to the lack of clear research priorities and to the dispersion of research efforts. The policy document "Agricultural Policy of Tanzania" is acknowledging the need to downsize the agricultural research system, to create fewer stations as well as to link research, extension and NGO's to the development and transfer of agricultural technology. This new policy document also acknowledges the recent reorganisation formulating research priorities at the level of 7 zones. This reorganisation took place in 1989 and in subsequent years based mainly on the recommendation and on the initiative of the World Bank and the Special Programme for African Agricultural Research (SPAAR). The World Bank in particular was instrumental in formulating a National Agricultural Masterplan conceived and carried out within a larger agricultural research restructuring programme entitled "**The National Agricultural and Livestock Research Project** (**NARPL1**)". The major components of the national project were:

- A new unified organisational structure for agricultural research including merger of former parastatals[16] under a Department of Research and Training (DRT) within the Ministry of Agriculture and Cooperatives (MoAC)
- The establishment of zones and Zonal centers
- Preparation of a Research Masterplan
- Supply and procurement of essential research facilities
- Skill improvement of research staff
- Rehabilitation of research stations and construction of a new headquarters for research
- Establishment of an Agricultural Research Fund

The total cost of the programme was estimated to be US$ 25.3 Million and was supported with funding by the World Bank/IDA, the African Development Bank/ADF and grants from the UK, Germany, the Netherlands and some funding from Tanzania.

The Tanzanian Agricultural Research Plan II (**TARP II**) is the follow-up of the efforts to strengthen the agricultural research service under MoAC after NARPL1. TARP II covers the period 1998-2002 for a total budget of USD 46 Million. The bulk of the funding is a loan from the World Bank/IDA (47.2%) and bilateral donor contributions (50.1%)[17], the rest comes from the Tanzanian Government (1.6%) and user fees (1.1%). TARP II contains the following components (World Bank, 1997):

- Decentralisation of research management with main responsibility at the Zonal level
- Zonal level autonomy with regard to resource allocation and decision making
- Small-holder demand-driven and farming system oriented research
- Private sector involvement
- Sustainable level of resource funding
- Proper information systems
- Incentives for Research Staff
- Collaborative research efforts with SUA and international collaboration

While the major part of the World Bank funding is for rehabilitation of centers, stations, and infrastructural investment, the heavy dependence of MoAC on donor funding to implement TARP II and in particular for operational costs raises some strong doubts concerning the long term sustainability of this ongoing agricultural research plan.

[16] Namely the Tanzania Agricultural Research Organization (TARO) which basically concentrated on crops and the Tanzania Livestock Organisation (TALIRO) for livestock research.

[17] Bilateral donors who pledged support include the following: the Netherlands (10.0); the UK /DFID (2.85); Germany/GTZ (2.50); Sweden/Sida (0.65); the European Union (5.60); Ireland (1.50); Norway/Norad (N/A) and Denmark/Danida (N/A).

Major Agricultural Research Institutions

Today most of the agricultural research institutions in Tanzania are organised under the Directorate of Research and Training (DRT) in the Ministry of Agriculture and Cooperatives (MoAC) which is also responsible for implementing the Tanzanian Agricultural Research Plan (TARP II). A National Agricultural Research Council has also been established in 1990 as part of the reorganisation under MoAC. The Council is only an advisory body and meets once annually. In addition to DRT and MoAC, the council consists of representatives from SUA, UDSM, the major agricultural research institutes, the Planning Commission and COSTECH. The Chairman of the Council is the Director General of COSTECH.

National Agricultural Research Institutes under MoAC: the Zonal Centers

The National Agricultural Research Institutes under MoAC consists of 7 Zonal Research and Training Centers according to agro-ecological conditions and farming systems, 8 Research Centers and 15 Research Stations. The aim is to decentralise responsibility to the Zonal Centers and to bring research and technology development closer to the farmers. Farmers and other user groups should have an influence on the running of the Centers since the Zonal Executive Committee consists of ¾ of non-scientists. The total number of staff employed in the National Agricultural Research Institute is estimated to be 1826 with 325 holding graduate degrees. As shown in table 5 below, the proportion of total PhD holders (18,6%) is much lower than at UDSM (61%) and SUA (71%).

Table 5 :Degree holders in National Agricultural Research Institutes

Degree	Male	Female	% Female	Total
PhD	44 (16,2)	10 (18,5)	18,5	54 (18,6)
MSc	151 (55,8)	30 (55,5)	16,5	181 (55,7)
BSc	76 (28,0)	14 (26,0)	15,5	90 (27,7)
Total	271 (100,0)	54 (100,0)	16,5	325 (100,0)

Table 6: Average age of degree holders in National Agricultural Research Institutes

Age	Male	Female	Total
Less than 30	-	-	-
31-35	15,0	10,5	14,5
36-40	24,0	38,5	26,5
41-45	31,5	31,5	31,5
46-50	22,0	17,5	21,0
51-55	8,0	2,0	6,5
Total	100,0	100,0	100,0

The comparison may not be completely fair since scientists in the National Agricultural Research Institutes are carrying out research programmes of a more applied nature. Yet, TARP II has set a target of achieving a scientific employment mix of 1:3:1 between degree holders. Contrarily to current assumptions, female scientists are relatively better qualified than male scientists (cf. Table 5). Another important characteristic is that many of the PhD holders are approaching the compulsory retirement age of 55 years. Thus

out of 54 PhD holders, two only are below 40 years (1 male and 1 female), and 40% will reach the retirement age in the next 5-6 years. Clearly, there is a major and urgent need for postgraduate training of present staff and of recruitment of young and qualified staff. In the event that the Tanzanian Government is not starting recruitment again the improved resources brought by TARP II will be grossly under-utilised or even not utilised at all.

Low salaries also contribute to instability in employement and in execution of research programmes. Government salaries for agricultural research scientists under MoAC, SUA and in many other research institutions in Tanzania are today largely inadequate to meet living costs for a scientist with a family. A month salary ranges approximately from USD 60 to USD 120. Many researchers must therefore turn to additional income earning activities to cover family living expenses and education costs for their children. Various types of non-salary incentives are somewhat compensating for the lack of salary incentives. Non-salary incentives, as documented in the interviews conducted, may include allowances most often provided by foreign grants (travel, per diem etc.), provision of housing and transport, free health care for the family, and travel grants to attend conferences and workshops in Tanzania and abroad.

Other Agricultural Research Institutions

In addition to the Zonal system, there are other specialised Agricultural Research Institutions with a national mandate. The most important ones are the Tanzanian Forestry Research Institute (TAFORI) established as a parastatal organisation under the Ministry of Natural Resources and Tourism with headquarters in Morogoro and 7 centers countrywide, the Tropical Pest Research Institute (TPRI) in Arusha that has a semi autonomous status and the Uyole Agricultural Research Center (UARC). Some agricultural research is also carried out at UDSM and on some private estates. The institutes include a special center for horticulture (the Horticultural Research Center), for irrigation of food crops (The Collima Agro-specific Research Center), wine research (the Viticulture Research and Training Center), animal diseases (the Animal Disease Research Center - ADR), and for trypanosomiasis (the Tse-Tse and Trypanosomiasis Research Institutes - TTRI). There is also the Center for Agriculture Mechanisation and Rural Technology (CAMARTEC) in Arusha partly financed by GTZ under the Ministry of Industry. Private research institutions include the Tea Research Institute of Tanzania (TRIT) based at Kifyulilo Tea Research Station with a staff of 12 postgraduate degree holders and the Tanzania Industrial Research and Development Organisation (TIRDO) that is a semi autonomous research enterprise carrying out agricultural research on a contractual basis. TIRDO has a staff of 80 with 17 holding postgraduate degrees.

Medical and Health Research

Three bodies are in charge of setting priorities and co-ordinating health research in the country: the Ministry of Health (MoH), COSTECH, and the National Institute of Medical Research (NIMR). By tradition, the division of labour between the MoH and NIMR was that NIMR was responsible for medical research and the Ministry for purely operational health systems research. This is about to change, as NIMR is also moving into research on health systems and services and getting more operational. COSTECH and the Ministry of Science and Technology are formulating the priorities for health research in general: the primary focus is placed on communicable diseases, in addition to maternal and child health (COSTECH, 1998).

Main institutions involved in medical and health research

Health research in Tanzania is centred around three categories of institutions: governmental health research institutions, universities (public and private), and private health research institutions.

a- Governmental health research institutions

Staff members engaged in research at the MoH are MSc holders only. Training of staff has been discontinued due to lack of funds. Funds for research are also very marginal at MoH. Following the collapse of the East African Community, the National Institute of Medical Research (NIMR) was established in 1979 as a parastatal organisation under the MoH. Following a workshop held in Dar es Salaam in 1996, NIMR has ordered its research priorities as follows: Malaria, Filariasis, Trypanosomiasis, Onchocerciasis, Schistosomiasis and sexually transmitted diseases including AIDS.

Table 7: Governmental Health Research Institutions

Institution's name	Research focus
Ministry of Health (MoH)	Applied research directed towards decision making and policy implementation
National Institute of Medical Research (NIMR) Parastatal under MoH	Contagious diseases -mainly medical research but health systems and socio-economic research is being strengthened
Tanzania Food and Nutrition Center (TFNR) Parastatal under MoH)	Food and Nutrition Issues

One of NIMR's primary challenges is to strengthen its research capacity. Out of a total staff of 200, NIMR has 58 scientists today (but 11 PhD holders only and 21 MSc or MA holders). The vast majority of scientific staff members are medical scientists. Whereas international circulation of research results is ensured through publication in peer reviewed journals (see research outputs below), the dissemination at the national level seems to be more problematic and relevance of the research in the Tanzanian socio-economic context is questioned. Very little efforts have also been made to link NIMR to university education in the health sector in Tanzania.

As for agricultural research, whereas staff salaries are paid by the Government, research activities are supported by donor agencies (mainly WHO, Sida-SAREC, DANIDA, European Union) mostly through research grants. The funding structure clearly favours donor control and results in poor funding of certain activities such as the core and coordinating functions of the institute.

With the nomination of a new Director General in 1998, a reform of NIMR research priorities and modes of operation is being implemented. The research agenda should move from pure medical research towards a multidisciplinary approach on health focusing more on health systems research and socio-economic issues. The research agenda is to be identified with a bottom-up approach. To that effect, an advisory scientific committee will be established at each center involving relevant stakeholders. NIMR also intends to change its name to the National Institute of Health research (NIHR). A memorandum of understanding

with the Muhimbili University College of Medical Science (MUCHS) is also being prepared on exchange of students and researchers/teachers. Partnerships with other research institutions in Tanzania will be encouraged in order to share facilities and competence and strengthen health research capacities in the country.

b- Universities, public and private

The Muhimbili University College of Medical Science (MUCHS), was established as a University college of UDSM in 1991. In addition to being part of UDSM, MUCHS is also part of the Muhimbili Medical Center (MMC). MMC consists of MUCHS and the Muhimbili Hospital. As part of MMC, the MUCHS staff receive their salaries from the MoH.

Table 8: Universities (public and private)

Institution's name	Research focus
Muhimbili University College of Medical Science (MUCHS)	Contagious and non-contagious diseases – mainly medical research
Tumaini University/Kilimanjaro Christian Medical College (KCMC)	Reproductive health, HIV/AIDS, maternal and child health, malaria
Mikocheni International University of Health Science Programmes	A new university in the process of identifying its research agenda

Research funding is also supposed to come from MoH, but most research is financed by donor support. In the 1994-95 financial year, the Government of Tanzania provided the Muhimbili Medical Center with a budget of Tsh 4.0 billion, out of which 0.1% (or the equivalent of USD 6,000!) was allocated to research. The same year, MUCHS received USD 1.0 million for research from donors. The main donors are: SAREC-Sida, NUFU, DANIDA, WHO, Carnegie Corporation, UNICEF and the World Bank.

At the beginning of 1999, NMC (including MUCHS) had slightly less than 3000 employees of which approximately 10% were academic staff. The proportion of PhD holders in the academic staff (9.22%) is much lower than on the main campus. The majority of the lectures are holders of the first MD degree.

The Kilimanjaro Christian Medical College (KCMC), which is today part of the **Tumaini University**[18]**,** is together with the **Mikocheni International University** (MIU) one of the two most important recently established private universities in the field of health in Tanzania. Both of them were accredited as universities in 1997. They are mainly supported by Churches and other donors. KCMC was first established by the Good Samaritan Foundation in 1971. The Norwegian Church Aid and NORAD support it today. MIU is a private institution owned by the Mission Mikocheni Hospital. KCMC has a larger staff and many more students than MIU. Both Universities are well equipped with modern medical technology. Whereas research is an important part of KCMC activities, there is currently no research taking place at MIU. As new course programmes are being initiated, KCMC[19] is experiencing increasing student enrolment (400 students at undergraduate and graduate level in 1998), MIU has a very low number of medical students (less than 20). One of the reasons is the very high student fee for Tanzanian conditions: USD 5-6000 per year including

[18] together with two other former Colleges: Makumira University College (theology and religion) and Iringa University College (business administration and journalism).
[19] KCMC currently offers training for the Doctor of Medicine degree programme.

accommodation on the campus. The relatively high staff salaries are financed through the revenues from the hospital.

c- Private Health Research Institutions

The main private research health center in Tanzania is the Ifakara Health Research and Development Center. Known as the Ifakara Centre, it was founded in 1957 as a field laboratory of the Basel-based Swiss Tropical Institute.

Table 9: Private Health Research Institutions

Institution's name	Research focus
Ifakara Health Research and Development Center	Entomology, malaria, schistosomiasis, socio-economic studies and traditional medicine
Primary Health Care Institute, Iringa	Continuing education for health workers. Not primarily involved in health research
Center for Education and Development in Health, Arusha (CEDHA)	Continuing education for health workers. Not primarily involved in health research

It is today operated as an independent foundation affiliated to the National Institute of

Medical Research (NIMR). The Ifakara Center, which is in a relatively good funding position, has developed strong collaborative links with Switzerland but also Spain, United Kingdom, Canada, the Netherlands and WHO. There are at present 8 expatriate staff members working at the Ifakara Center.

To finish this very brief presentation of health research activities in Tanzania, there are two emerging institutional developments worth mentioning in the field of health research in Tanzania: the establishment in 1997 of a **Health Research Users' Trust Fund**, and the creation in early 1999 of a **National Health Research Forum**.

The Trust Fund started as a cooperation between the Ministry of Health and the Swiss Development Cooperation (SDC). Its mandate is to establish a mechanism for funding priority demand driven health research, as expressed by policy/decision makers, health care providers and communities at large. The Trust Fund publishes the Tanzania Health Research Bulletin (normally twice a year, but so far only once) and it has also launched a national research grant scheme (see below).

The National Health Research Forum is an initiative of the National Institute of Medical Research (NIMR). It is a new scheme established in February 1999 for the coordination of health research activities in Tanzania. This Forum will also be a consultative and advisory body to all institutions involved in health research.

In addition to these initiatives, the efforts towards co-ordination at the regional level of East Africa are in progress. A Memorandum of Understanding including a common health secretariat is being planned. NIMR organises annual regional meeting with the East African networks.

1.3- Research Funding and Research Aid Dependency[20]

Main actors

As pointed out in the genesis and the development of research and higher education institutions in Tanzania, foreign support has become a must at each stage of research capacity building including PhD studies. The Tanzanian system is surviving because it attracts external financial support. Without these major subsidies, and numerous microprojects, very little research would be conducted in Tanzania.

Nevertheless, official publications advocate the importance of science for the development of the country. The last publication (1996) stated that 1 % of the GNP should be allocated to science and technology (S&T), but its impact is likely to be as limited as that of the previous texts. It is difficult to obtain reliable information on the financing of S&T activities by the Tanzanian government which was about 0,35 % of the GNP in the early 1990's (Widstrand, 1992; 1996). It has probably remained at the same level since then. Such a low level is hardly enough to pay salaries and other personal costs.

Foreign funding agencies concentrate on particular institutions or faculties (notably the two main universities: University of Dar es Salaam–UDSM ; and Sokoine University of Agriculture –SUA). The table below shows the most important and long-term aid in the last 15-20 years (Table 10).

Table 10*:* Long term aid to Tanzanian research

Agencies	Country	Tanzanian beneficiaries
NORAD	Norway	SUA Faculty of Forestry
NORAD	Norway	UDSM Department of Chemistry
NORAD	Norway	UDSM Department of Chemical and Process Engineering
FINNIDA	Finland	UDSM Department of Geology
DANIDA	Denmark	SUA Department of Animal Science
SDC	Switzerland	UDSM Departments of Mathematics and Physics
GTZ	Germany	UDSM Faculty of Engineering
NUFFIC	The Netherlands	UDSM Department of Microbiology
SAREC-ISP	Sweden	UDSM Department of Seismology
"	Sweden	UDSM University Library
World Bank	International	MoAC Rehabilitation of Agricultural Research Centers

In the field of agricultural research, bilateral cooperations occurs in conjunction with the support from the World Bank in order to implement National Research Programmes (NARPL1 and TARP II). In addition to the European Union, 7 European countries are involved: UK (DFID), Germany (GTZ), the Netherlands, Sweden (Sida), Norway (NORAD), Denmark (DANIDA) and Ireland.

The Sokoine University is a typical example, and not at all exceptional, of external dependence. Between one third and one half of SUA's expenses are covered by aid, a dependence that has increased in the last three years. The following figures show the

[20] This part is drawn from Gaillard and Waast, 1999.

importance of foreign contributions at SUA in the past 6 years (Graph 1) and the main budgetary sources in 1997-1998 (Graph 2). The dependence of strictly research activities on aid is even greater, foreign support representing more than 90 % of their financing.

NORAD has become by far the main foreign financial source since Denmark (DANIDA) reduced its contribution[21]. The other main donors are among others ENRECA (Danish programme), VLIR (Conseil Inter-Universitaire Flamand), the USAID and the European Union. Different countries are also represented (Australia, the United States, France, Japan, the Netherlands among others), as well as NOGs, and several regional or panafrican organizations. In total, not less than 48 foreign sources finance research and postgraduate studies at SUA! See attached list (Table A1). This variety of supports, which are to be justified one by one, causes severe management, accounting and co-ordination problems.

A multiple professional dependency

The dependence on foreign aid not only affects research activities, it also shapes the profession of researcher. It begins with the need of grants to obtain graduate and postgraduate degrees. Every university staff who has not completed his education strives to do a Master or a PhD. Out of the 251 candidates pre-registered for postgraduate studies at the Sokoine Agriculture University in September 1998 (mainly Masters), 3 could finance their studies, and 99 could register after having obtained a grant to pay the registration fee and their education. More than 90 % of these grants came from foreign sources, among which 53 from NORAD (Norway) and 13 from the Belgian Cooperation (Research News, 1998). Without foreign aid, it is impossible to go on a training, even in Tanzania. The difficulty to obtain such support partly explains the fact that Tanzanian scientists are obtaining their higher degrees at a relative advanced age.

All researchers we interviewed in Tanzania depend on foreign aid to finance their work. A period in a laboratory abroad (to prepare a thesis for example) increases their chances of obtaining financial support. The foreign aid they receive not only serves to purchase equipments and supplies, but actually constitute a survival strategy for the researchers and their families. In addition, researchers try and complement their salary either with travel expenses, or with per diems given to attend meetings and conferences. The most fortunate ones manage, within programmes financed with foreign funds, to buy a vehicle they use for more than strictly scientific purposes. Many foreign agencies and programmes are concerned by this problem of inadequate salaries. As a matter of policy, some agencies as SAREC in Sweden, do not contribute to the salaries of developing countries personnel[22]. Others, like ENRECA in Denmark, include salaries in their support or research incentives. TARP II intends to provide research incentives through establishment of monetary awards for outstanding research performance and awards for publications.

However, these complementary incomes are usually not sufficient and many researchers have to work as consultants in areas linked more or less to their speciality[23]. These consultancies, the rates of which increasingly approach international rates, are also nearly

[21] In 1994, NORAD's contribution represented 83% of foreign aid. Today, it represents more than 70%.

[22] The main rationale behind this policy is the following: if research is a priority for a developing country, it should be translated into adequate salaries for its nationals engaged in research work (see Bhagavan, 1992).

[23] The monthly salary of a researcher or a university academic staff, varies from a few hundreds USD to 900 USD. The latter amount corresponds to the salary of a Professor at the end of his career. Based on some 20 interviews carried out in Tanzania, we can estimated that Tanzanian scientists have to multiply they salaries by 3-5 to leave decently.

always financed by foreign organisations and most of the time carried out in Tanzania, but also in the rest of the world. These exceptional incomes from consultancies are often invested in a company or a shop managed by a member of the researcher's family, often their spouses[24]. Most often, academic staff members from Sokoine University of Agriculture (and the researchers from agronomical institutes) invest in agricultural productions and firms; and those from UDSM (and the other research institutes) invest in services like transport or small shops. Most often, consultancies are carried out in the framework of agreements contracted directly with the scientists, or through small consultancy firms created with other colleagues. Institutions to which the scientists belong try to better control this new development and take advantage of it. Thus, the University of Dar es Salaam (USDM, 1997), has recently created a "University Consultancy Bureau" but so far scientists do not seem to be willing to contract consultancies through it. The main reason being that this bureau is withholding 25% of the consultancy fees

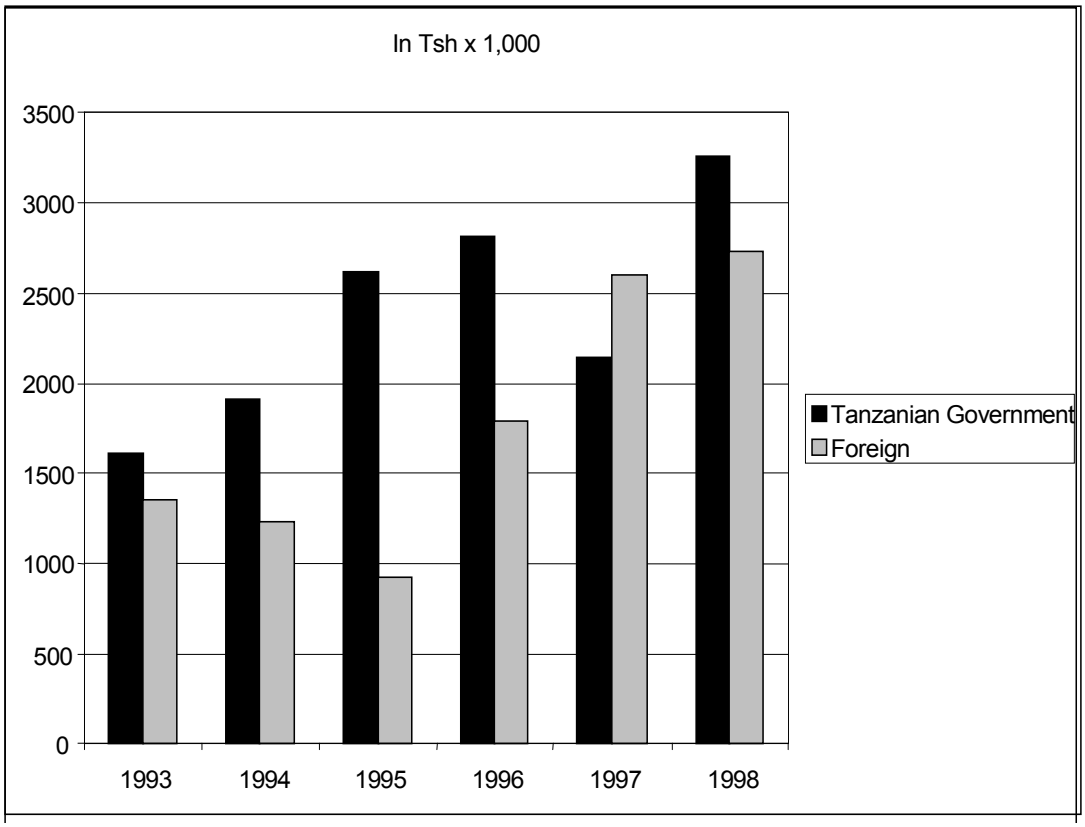
Finally, the Tanzanian researchers are dependent on foreign colleagues at each stage of their scientific work, from access to literature to analysis of samples requesting the use of equipment in working order or not available in Tanzania. They also usually need a foreign co-author, as a guarantee, to facilitate publication of their works in international journals. South-North scientific cooperation is therefore most often a necessary condition for Tanzanian scientists to promote international contacts and enhance the scientist's credibility within the international scientific community. But the partnership also too often remains a collaboration between unequal partners leading to a division of work consigning the Tanzanian partner to field activities more than to analytical work[25].

Thus, Tanzanian scientists, as in many other African countries, depends on foreign financing. As we saw before, this dependence is nearly total regarding support of research programmes, and carries a strong risk of implicating the donor in the orientation of research choices of subject area.

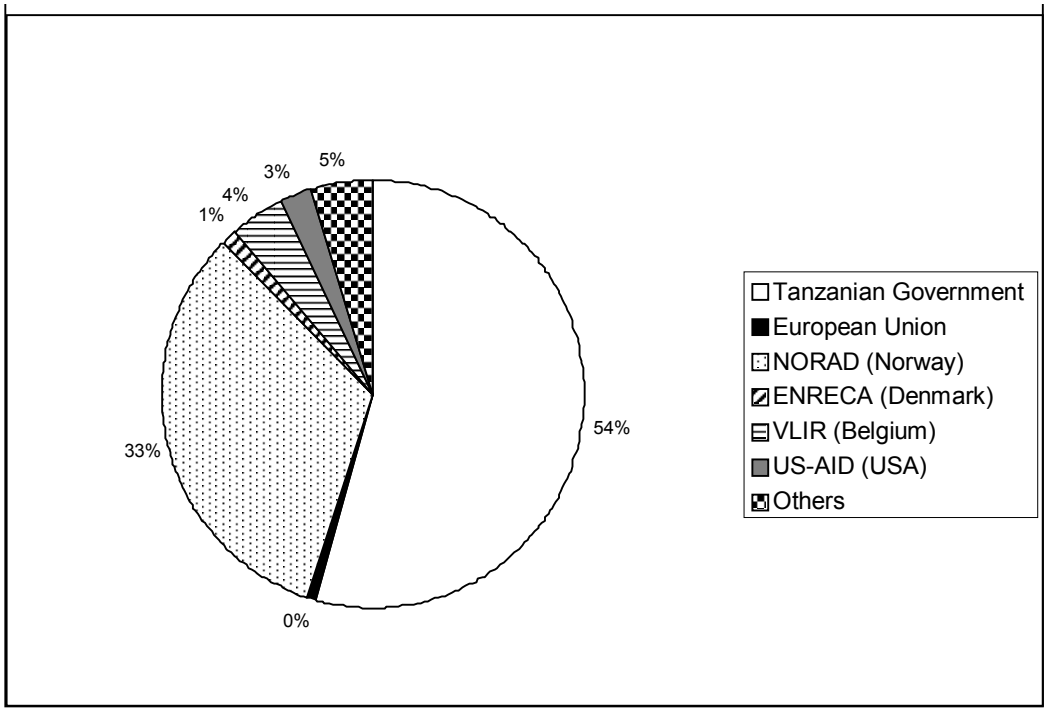
[24] As we saw earlier, only 10% of university academic staff in Tanzania are women.

[25] For a more in depth discussion concerning the division of labour between researchers in the North and the South see Gaillard (1994); Gaillard and Schlemmer (1996).

Graph 1: National and Foreign Funding at SUA



Graph 2:Main Funding Sources at SUA



1997-1998 Source: Research News, SUA, 1998.

Changing modalities for research funding

Thus, Sida-SAREC, which over the last 20 years became a very important strategic donor for research activities in Tanzania, has changed its mode of intervention and the way it is channelling its support over the years[26]. The SAREC[27] support to Tanzanian research dates back to 1977. At that time, most of the funds were channelled through the National Science Council (UTAFITI), based on the idea that the rather newly established research council should not be bypassed if it were to play its national coordinating role. After an evaluation conducted by SAREC in 1985, the support to UTAFITI was, in effect, discontinued in 1986, at the time COSTECH was established. Later, the emphasis was put on bilateral research cooperation and direct cooperation between research institutions in Sweden and in Tanzania as an important way of building research capacity and providing additional research training opportunities. Collaborative projects increased significantly in the late 1980s and early 1990s. This approach has contributed to increased Swedish capacity in development research and to the internationalisation of Tanzanian science, but it has also brought negative effects such as fragmentation problems at the local university level through selective support[28]. In the late 1980s and during the 1990s, SAREC support to regional research institutions and regional research projects involving several institutions also increased. Thus, Tanzanian institutions were involved in an archaeology network programme in East Africa, a Coastal Management Programme, and the participation of Tanzanian scientists in the African Economic Research Consortium.

Altogether, SAREC support to Tanzanian research has combined key areas of strategic importance: development of institutional capacity, development of academic capacity, strengthening of regional cooperation and internationalisation. Yet, SAREC has since the early 90s been rethinking its overall strategy based on the assessment that the research aid process had, in many cases, been too much supply- or donor-driven (including by individual Swedish researchers) and that consequently, Tanzania had not been able to develop national research priorities. In other words, "many years of donor influence and donor-imposed research projects and ideas have made the research community inclined to listen very carefully to donors and adapt readily to suggestions" (Widstand, 1996: 41). Based on the agreement that focus should now be put on local needs and local level support, it was decided that decision-making and research funds should be moved to Tanzania and administered locally by the Universities and more precisely some Faculties of UDSM[29]. The new model is therefore called "faculty support". In addition to the support of MSc and PhD programmes in Tanzania, the purchase of research equipments, vehicles, hardware to link into the forthcoming Internet network, travel to attend international conferences, the funds made available for "faculty support" should in particular strengthen peer reviewed research grant schemes at the faculty level.

Sida-SAREC is not the only foreign aid institution targeting its support directly to the faculties and institutes of UDSM and promoting the development of national or institutional research grant schemes. NORAD which, among others, has some experience of this type of

[26] For a detailed presentation of SAREC approaches see Bhagavan (1992).
[27] SAREC, which was established in 1975 as the Swedish Agency for Research Cooperation with Developing Countries, merged with Sida in 1995 to become a Department of Sida: the Department for Research Cooperation (Sida-SAREC).
[28] For a general discussion concerning North-South Research partnership see Gaillard (1994) and Carlsson (1995).
[29] It is not a new way of thinking. Recognition of local needs were recognized by development cooperation policies as early as the late 50s and early 60s (Gaillard., 1999) but the modalities proposed to address the issue are new.

funding however recently recognised that this kind of support may tend to create islands of excellence in a weak University structure. Under a new Framework agreement between UDSM and NORAD (effective from July 1997), allocated funds go through the central level. The idea behind the present agreement is to provide a more balanced and coherent support to the University and not only to its individual faculties and departments (NORAD, 1999). One step further, one could also argue that direct support to Universities and Institutes might also weaken the national coordinating bodies for research and higher education policies, at which level national research priorities should be formulated. This is one of the main reasons why DANIDA is supporting the COSTECH research grants Fund. The next section gives a brief account of the different existing initiatives to date.

The emergence of national research grant schemes

The **National Fund for the Advancement of Science and Technology** (NFAST) administered by COSTECH was established in 1995. It is a selective research grant scheme with limited support from the Tanzanian Government and Denmark (DANIDA). It was recommended that the NFAST be launched with a fund of 1,000 Million shillings with a provision for an annual budget not less than that amount. Till now the Government has granted 30 Million shillings in 1996, 24 Million shillings in 1997 and 150 Million shillings had been promised for 1998/99. Denmark has provided the NFAST with 47.5 Million shillings. (approx. USD 70,000). The NFAST committee responsible for grant allocations met last time in July 1997. Most recommended grants for 1996/97 were not awarded due to budgetary constraints. According to researchers met at UDSM, the application procedure is cumbersome and the decision process lengthy. Thus, NFAST did not succeed in establishing itself as an attractive research grant scheme.

The **Agricultural Research Fund** established in 1991 as a competitive fund for financing high quality research is administered by DRT in MoAC. According to NORAD[30], criticisms related to slow and cumbersome handling of research proposals and the fact that the fund does not cover some basic operational costs has made the fund less attractive than expected. A **Zonal Agricultural Research Fund** (ZARF) is also being created and three pilot Zones have been selected (Northern, Eastern, and Southern). Funding to the Zonal Fund is intended to come from bilateral donors, NGOs and the private sector.

Sida-SAREC Faculty support model. There are 13 programmes under the Sida-SAREC support at UDSM, which include all faculties (except the Faculty of Law), institutes, staff training, Gender Dimension Programme, PMU and UCLAS.

The Health Research Users' Trust Fund. This Trust Fund with support from the Swiss Development Cooperation (SDC) invites research proposals from health professionals. The scheme is advertised nationally and all researchers can compete for funding. The first invitation to tender has taken place: 14 applications were received, of which 5 were approved.

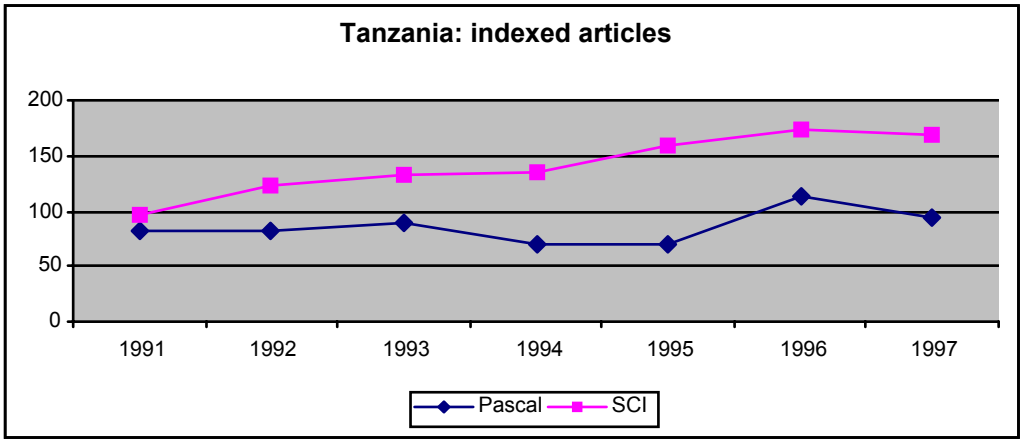
[30] The existence of this fund was discovered after the visit, while reading the NORAD report (1999) back home. In 1995, 10 out of 52 received proposals were granted. The information reported here comes from NORAD (1999).

1.4- Research outputs[31]

With approximately 100-200 articles published in mainstream journals indexed in international databases during the 1990s (1991-97)[32], Tanzania annual research outputs are very low as compared to the size of her national scientific community. On the African scene, Tanzania ranks 8th with approximately 2% of the total African production[33]. Yet, despite the constraints described earlier, Tanzania has significantly increased its scientific production during 1991-97 (see Fig. 3).

According to the ISI database, a big share of the Tanzanian scientific production is due to clinical medicine (57%), followed by biology (24%), and biomedicine (10%). Earth sciences (mainly soil and environmental sciences) account for 4%, engineering and technological sciences for 2%, and physics, chemistry and mathematics 1% each. This production is spread in more than 100 institutions in Tanzania, many of them being responsible for a very limited number of publications[34]. At the same time there is a high concentration in a limited number of institutions with the first four producing half (49,6%) of the total scientific production (see Table 11).

Figure 3



[31] This section draws on Narvaez et al., 1999.
[32] We looked into two databases: SCI (US) and PASCAL (France).
[33] In the ISI databse and 11th in the PASCAL database, but whereas ISI has a bias in favour of english speaking countries, PASCAL has a bias in favour of french speaking countries. That is why we used ISI data for Tanzania in the rest of this section.
[34] 66 institutions have produced only one publication (17: 2, 14: 3, 6: 4 and 7: 5).

Table 11: Top ten research-producing institutions in Tanzania1991-97

Institutions	Number of publication in ISI	%
University of Dar es Salaam (UDSM)	266	17.7
Muhimbili Medical Center (MMC)	191	12.7
Muhimbili University College of Medical Science (MUCHS-part of MMC)	154	10.3
Sokoine University of Agriculture (SUA)	134	8.9
National Institute of Medical Research (NIMR)	91	6.1
Ministry of Health (MoH)	66	4.4
Kilimanjaro Christian Medical College (KCMC)	42	2.8
Ifakara Health Research and Development Center (IHRDC)	33	2.2
Tanzania Food and Nutrition Center (TFNR-under MoH))	31	2.0
Amani Medical Research Center (under MoH)	26	1.7
Remaining 139 institutions	468	31.2
Total	1502	100.0

Among the top four are the two public universities (UDSM and SUA) and the Muhimbili University College of Medical Science (MUCHS) which is part of the Muhimbili Medical Center (MMC). The main private institutions in the field of Health research (KCMC and IHRDC) occupy a satisfactory position given their respective size. The agricultural (and forestry) research institutes are not absent from the list but are listed lower down with just a few publications. The first one to appear is the Tanzanian Forestry Research Institute in 16th position with 15 publications followed by the Central Zone Research Institute in Mpwapwa (Livestock Research Center) in 21st position with 9 publications. This could be due in part to the bias of the ISI database which tends to underestimate agricultural sciences but the main reasons are probably due to the fact that agricultural scientists in Tanzania are less qualified, publish relatively less and in less visible journals.

Another marked characteristic of the Tanzanian scientific production is that it is highly dependent on international collaborations (see Fig.4). With as much as 72% of the articles being published with foreign authors, Science in Tanzanian appears to be at the same time the most international and the most dependent of all African countries. Not surprisingly for an English speaking country, foreign co-authors are predominantly from the US (21%) and from the UK (19%) where the Tanzanian scientists have been predominantly trained, but the relative importance of Swedish (10%), Dutch (10%), Swiss (6%), Danish (5%), German (4%) and Norwegian (4%) co-authors is no doubt to be related to the long standing cooperation programmes with the corresponding countries (see Figure 5). Continent wise, Europe with 2/3 of the papers published with European authors, is by far the first continent with which Tanzanian scientists are collaborating. North America (24%) and Africa (7%) follow. Interestingly, collaborations with Africa are predominantly with Kenya (4%) and to a lesser extent Uganda (1%), Tanzania's former partners in the East African Community. Asia accounts for 3% only.

Figure 4

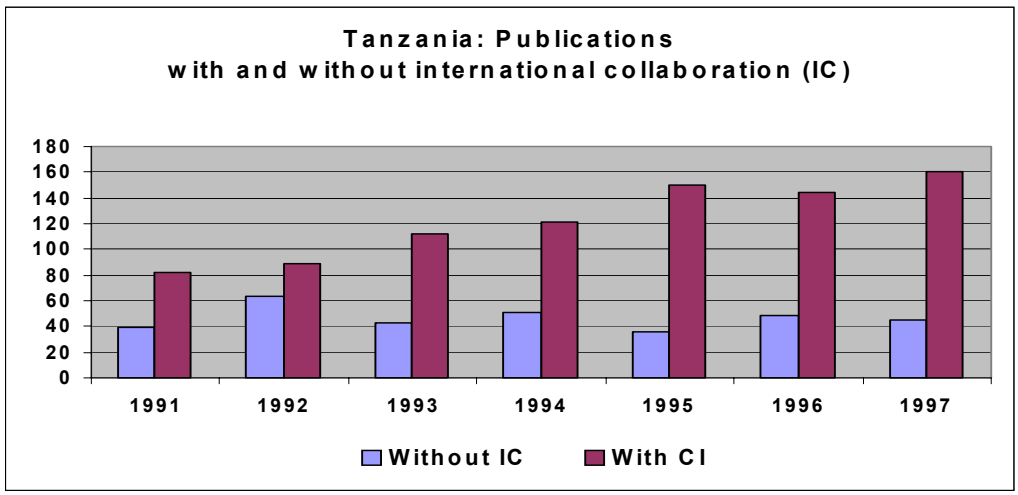
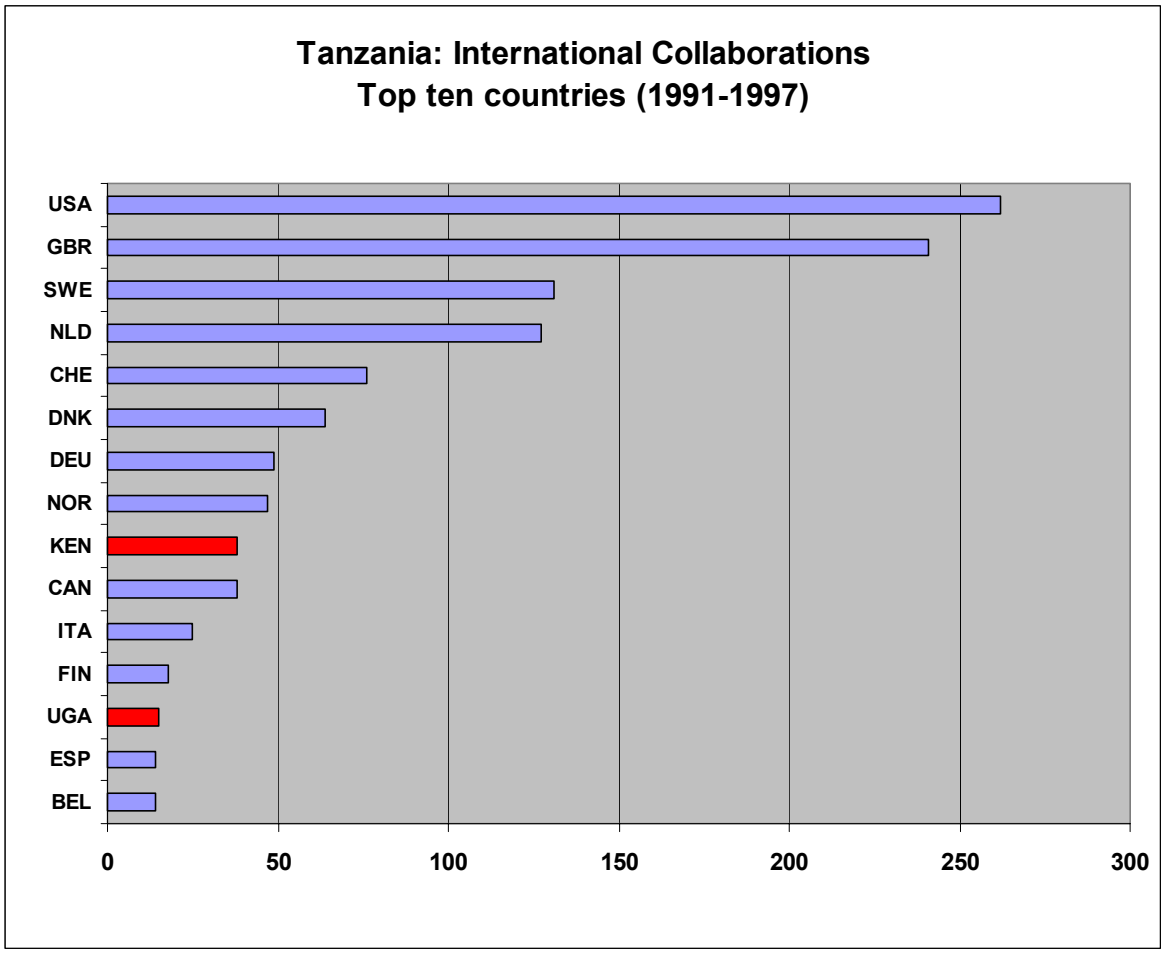

Tanzania: Publications
with and without international collaboration (IC)
180
160
140
120
100
80
60
40
20
0
1991
1992
1993
1994
1995
1996
1997
Without IC
With CI

Figure 5


Tanzania: International Collaborations
Top ten countries (1991-1997)
USA
GBR
SWE
NLD
CHE
DNK
DEU
NOR
KEN
CAN
ITA
FIN
UGA
ESP
BEL
0
50
100
150
200
250
300

Concluding remarks

Of a relatively recent origin, the Tanzanian scientific community, can be characterised as follows:

- relatively highly trained: there is a high proportion of scientists with PhD particularly in the University;
- ageing: no recruitments took place in the public sector over the last 6-7 years, thus threatening the reproduction of the ageing national scientific community;
- grossly underpaid: although difficult to estimate, funding coming from the Tanzanian government for R&D activities would correspond to approx. 0,3% of GNP; it is exhausted once the (very low) salaries and other related costs are paid;
- nearly totally dependant on foreign aid both for training (MSc and PhD studies - including for training programmes in Tanzania) and research activities; without foreign aid hardly any research activities can be undertaken (cf. Gaillard and Waast, 1999).

Thus, Tanzanian research scientists are unable to survive on their salaries alone. They derive a larger share of their disposable income from various allowances and activities among which farming and business, and increasingly, consultancy activities. Not surprisingly, internal mobility (for better-paid positions outside the national research system) and regional mobility (mainly to neighbouring countries or countries of the SADC region) is on the increase. As a consequence, overall research outputs are poor. Yet, Tanzania has maintained and even increased its relative position in African science in recent years.[35]

[35] Measured by number of publications per researcher. In five years (1991-1996), compared with Europe or the rest of the world, Africa has lost 20-25% of its relative capacity to make contribution to world science. Furthermore, the paths of different countries have diverged enormously. Thus, whereas Nigeria is collapsing, Tanzanias relative share in Africa continues a steady growth: 11% increase during 1991-1996 (Arvanitis, Waast and Gaillard, 1999).

References

ARVANITIS R, R. WAAST and J. GAILLARD. 1999. “Science in Africa: a Bibliometric Panorama Using PASCAL Database”. Accepted for publication in *Scientometrics*.

BHAGAVAN M.R. 1992. The SAREC Model: Institutional Cooperation and the Strengthening of National Research Capacity Building. Stockholm: SAREC.

CARLSSON J. 1995. The University, its Faculties and Departments. Toward an Integrated Approach to the Support to Higher Education and Research. Paper for SAREC seminar on Support to Research and Training for Research in the Social Sciencesand Humanities at African Universities. Värnamo: 3-4 May 1995.

COSTECH. 1996. Research Grants Manual.

COSTECH. 1998. Priority Areas of Research and Development in Tanzania.

GAILLARD J. 1994. “North-South Research Partnership: Is Collaboration Possible between Unequal Partners?” *Knowledge and Policy*, Vol.2(2): 195-228.

GAILLARD J. and B. SCHLEMMER. 1996. "Chercheurs du Nord, chercheurs du Sud: itinéraires, pratiques, modèles - un essai d'analyse comparative", *in* R. WAAST (ed.), *Les sciences au Sud: états des lieux*, Paris: ORSTOM Editions, Collection Sciences Hors Occident au XXème siècle, pp. 113-135.

GAILLARD J. and R. WAAST. 1999. “L'aide à la recherche en Afrique Sub-Saharienne: comment sortir de la dépendance ? Le cas du Sénégal et de la Tanzanie”. Accepted for publication in *Autrepart*.

NARVAEZ N. and alii.

NORAD. 1999. Norwegian Research Support to Developing Countries: The Case of Tanzania. Oslo: NORAD, 157 p.

Research News. Research and Postgraduate Studies Newsletter, Morogoro: Sokoine University of Agriculture, Vol.8 (2), December 1998.

SHIJA J.K. 1996. The High Price of Excellence in Tanzania: A Personal Voyage. Dar es Salaam: DUP, 88 pages.

URT (The United Republic of Tanzania). 1998. Financial Sustainability of Higher Education in Tanzania. Dar es Salaam: MSTHE, 141 pages.

Widstrand C. (1992), Tanzania: Development of Scientific Research and SAREC’s Support 1977-1991, Stockholm, Sida-SAREC.

Widstrand C. (1996), The University of Dar es Salaam and Swedish Support to Capacity Building, Stockholm, Sida-SAREC (Departement for Research Cooperation).

World Bank. 1997. Project Appraisal Document on a Proposed International Development Association Credit to the United Republic of Tanzania for an Agricultural Research Project, 30 pages.

List of acronyms

ADR	Animal Disease Research Center
CAMARTEC	Center for Agriculture Mechanisation and Rural Technology
CARC	Collima Agro-specific Research Center
COSTECH	Tanzanian Commission for Science and Technology
HRC	Horticultural Research Center
MSTHE	Ministry of Science, Technology and Higher Education
NARPL1	National Agricultural and Livestock Research Project
NFAST	National Fund for the Advancement of Science and Technology
NORAD	Norwegian Agency for Development Cooperation
NUFU	Norwegian National Committee for Development Related Research and Education
PMU	Programme Management Unit
SAREC	Swedish Agency for Research Cooperation with Developing Countries
Sida	Swedish International Development Agency
TAFORI	Tanzanian Forestry Research Institute
TARP II	Tanzanian Agricultural Research Plan II
TIRDO	Tanzania Industrial Research and Development Organisation
TPRI	Tropical Pest Research Institute
TRIT	Tea Research Institute of Tanzania
TTRI	Tse-Tse and Trypanosomiasis Research Institutes
UAC	Uyole Agricultural Research Center
UCLAS	University College of Lands and Architectural Studies
UTAFITI	Tanzanian National Science Research Council
VRTC	Viticulture Research and Training Center

Table A1:Foreign institutions supporting research and postgraduate studies at SUA

AAS	African Academy of Science
AFRNET	African Feed Resources Network
BADC	Belgian Agency for Development Co-operation
DFID	Department for International Development (UK)
CASEC	Community Aid Small Enterprises Consultancy
CIAT	Centro International de Agricultura Tropical
CIDA	Canadian International Development Agency
DAAD	Germany Academic Exchange Service
CIFOR	Centre for International Forestry Research
CSID	Centre for Sustainable Development
CSIRO	Commonwealth Scientific Industrial and Research Organisation of Australia
DANIDA	Danish International Development Agency
ELCT	Evangelical Lutheran Church of Tanzania
ECEP	Environmental Capacity Enhancement Project
ENRECA	Enhancement of Research Capacity in Developing Countries (DANIDA)
EU	European Union
EARMESA	Farm Level Applied Research Methods for East and Southern Africa
FAO	Food and Agricultural Organization of the United Nations
FFACI`	French Food Aid Counterpart Fund (French Embassy, DSM)
FINNIDA	Finnish Development Agency
GTZ	German Technical Co-operation
IAEA	International Atomic Energy Agency
IBSRAM	International Board for Soil Research and Management
IAEA	International Agricultural Engineering Association
ICRAF	International Research Centre for Agroforestry
ICRISAT	International Crop Research Institute for Semi-Arid Tropics
IDRC	International Development Research Centre
IFS	International Foundation of Science
IFUW	International Federation of University Women
ILRI	International Livestock Research Centre
INR	Institute of Natural Ressources
JICA	Japanese International Co-operation Agency
NORAD	Norwegian Agency for Development Co-operation
NRS	Norwegian Research Council
NORAGRIC	Norwegian Centre for International Agric. Development
NUFU	Norwegian Council of Universities for Development, Research and Education
NIRP	Netherlands Israel Research Development Programme
OSSREA	Organization for Social Science Research in Eastern Africa
REPOA	Research on Poverty Alleviation
SACCAR	South African Countries Centre for Agricultural Research
SADC	Southern African Development Co-operation
SASAKAWA	SASAKAWA Global 2000
SIDA	Swedish International Development Agency
UNDP	United Nations Development Programme
USAID	United States of America Agency for International Development
USDA	United States Department of Agriculture
VLIR	Flemish Inter University Council
WFP	World Food Programme

Appendices

List of people met by Jacques Gaillard (1-17 February 1999)

The Tanzanian Commission for Science and Technology (COSTECH)
Ali Hassan Mwinyi Road,
P.O. Box 4302, Dar es Salaam
Tel. (255 51) 700745-6, 75155, 75311-2
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Samuel ASMAN
Theophilus E. MLAKI, Director Information and Documentation
Issa A.N. MUNISI, Chief Scientific Officer & Ag. Director for Research

The University of Dar es Salaam
Office of the Vice Chancellor
Prof. P.N. MATERU, Director, Postgraduate Studies
Prof. T.S.A. MBWETTE, Manager, Planing Management Unit
Mr. A. KITAGULA, Planning Officer

Main Library
Mrs. M.M. MATERU-BEHISTA, Assistant Librarian

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Prof. Mayunga H.H. NKUNYA, Dean
Nkunya@chem.udsm.ac.tz
Department of Botany
Prof. Frank ELIA, Head
Zoology Department
Prof. KASIGWA, Acting Head
Physics Department
Dr. Edward MUHAMILAWA, Executive Secretary NUSESA

Institute of Development Studies
Prof. Ibrahim F. SHAO, Associate Professor & Director
Dr. Samuel E. CHAMBUA,

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Faculty of Medicine
Prof. F.S. Mhalu, Dean
P.O. Box 65001
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Institute of Traditional Medicine
Muhimbili Medical Centre
P.O. Box 65001
Prof. Rogasian L.A. Mahunnah, Director
E-mail: ditm@Muchcs.ac.tz
Dr. M.C. Kapingu
Dr. M.J. Moshi
Mrs. F.C. Uiso
Dr. Z.H. Mbwambo

Sokoine University of Agriculture (SUA)
P.O. Box 3019, Morogoro, Tanzania
Prof.W.Abeli, acting Director of Research and Postgraduate Studies
Faculty of Agriculture
Dr. Robert B. Mabagala, C/2157-1, Dean (was not in Morogoro during my visit)
Department of Animal Science and Production
Dr. S.M. Ndabikunz, B/1763-1X
Department of Crop Science
Dr. Susan Nchimbi, C/1802-1X
Department of Food Sciences and Technology
Mr. Jovin K. Mugula, E/2470-1 (registered at Ås for PhD)
Dr. Monica Lyomo, E/2877-1
Faculty of Forestry
Department of Forest Biology
Dr. Esron Munyanziza, D/1944-2 (leaving for South Africa)
Faculty of Veterinary Medicine
Department of Veterinary Medicine
Dr. Nkumbukwa M.A. Mtambo, B/2226-1
Department of Veterinary Microbiology
Prof. Paul Simon Gwakisa, B/2510-1
Prof. Ayub Ahmad Kassuku, B/1204-2
Department of Veterinary Pathology
Prof. Jayro A. Matovelo

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Mr. Joseph K.L.Mugyasuso
Mr. Peter John Kilwele

Government Chemist Laboratory
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Mr. Canute A. MTEMA, Principal Chemical Laboratory Technologist

Tropical Pesticides Research Institute
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Website: http://www.habari.co.tz/tpri

Dr. D.F.P. Ringo, Director
Mr. Jonathan L. Ak'habuhaya, Registrar of Pesticides (E/1587-1X)
Mr. Thomas J. Mbise, Principal Research Officer (rodents)
Dr. Rashan Abdallah, Head, Post Entry Plant Quarantaine Services (Virology/Biotech)
Dr. Jasper Natham Ijumba, Principal Research Officer (Entomology/Malaria)
Dr. Afihinisim Ijani, Plant Pathologist
Mr. Bakari Kaoneka, Natural Products Chemistry, PhD to be defended (former unsuccessful applicant)
Mr. James J. Matee (Bird Pests - Ornithology)

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Ms. Narriman Saleh Jiddawi, Research Fellow,

Ministry of Agriculture, Livestock & Natural Resources
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E-mail: ppdznz@twiga.com
Dr. Kassim Gharib Juma, Commissioner of Livestock and Agriculture
Mr. Upozo Salmin Ufuzo, ZARC Secretariat
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Zonal Research and Training Centre
Livestock Production Research Institute
P.O. Box Mpwapwa
Dr. Constantine Shayo, B/2229-2
Mr. Eligy J.M. Shirima, B/2517-1 (moved to Tanga)
Angello J. Mwilawa, AB/10570 Rev.
Daniel Komwilhangilo, AB/11316

Embassies

French Embassy
Melle Marie Claire Gerardin
Premier Conseiller
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Royal Norwegian Embassy
Inger Sangnes
Education (Second Secretary)
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Grantees met in Sweden
Frank A. MREMA, D/2181-1 (93-)
from Tanzania Forestry Research Institute
now at Department of Short Rotation Forestry for PhD studies
SLU / UPPSALA

Shoshinder DAS, B/1023-3F
From Livestock Production Research Institute
MPWAPWA Met at SLU/Department of Animal Nutrition and Management and IFS Secretariat

Interviews conducted by Jacques Gaillard

Name	**Institution**
NKUNYA, Mayunga H.H	UDSM
ELIA Frank	UDSM
Ndabikunz, S.M	SUA
Nchimbi Susan	SUA
Mugula Jovin K	SUA
Monica Lyomo	SUA
Munyanziza Esron	SUA
Mtambo Nkumbukwa M.A.	SUA
Gwakisa Paul Simon	SUA
Kassubu Ayub Ahmad	SUA
Matovelo Jayro A.	SUA
LORRI Wilbald	TFNT
MULOKOSI Generose	TFNT
Ak'habuhaya Jonathan	TPRI
Jiddawi Narriman Saleh	IMS
Shayo Constantine	LPRI
Shirima Eligy	LPRI
MREMA Frank	TFRI
BWATHONDI Philip O.J.	TAFIRI

2- SYNTHÈSE BIBLIOMÉTRIQUE, 1991-1997.

La Tanzanie.

Source : base bibliographique PASCAL, nettoyée; années 1991 à 1997. Les chiffres suivants ne concernent que des Articles publiés, à l'exclusion des ouvrages, thèses, notes et compte-rendus de lecture.

1. VOLUME

688 références
Moyenne : 100 par an; au 11° rang du Continent : 1/60 de sa production;
C'est l'équivalent de pays comme le Cameroun, la Côte d'Ivoire, le Sénégal, le Zimbabwe ou l'Ethiopie. Fait notable : cette production va croissant : + 50 % en 7 ans (notamment depuis 1996), malgré des conditions de financement national déplorables.

Ces données, tirées de PASCAL, sont justes pour ce qui est de la tendance. Mais elles sont sous-estimées du fait du double biais de la base, francophone et de moins en moins tiers-mondiste. Pour corriger ces biais, ici de forte incidence, nous avons confronté les résultats avec ceux de la base américaine SCI. Celle-ci enregistre :

	1991	1992	1993	1994	1995	1996	1997	Total
PASCAL	85	86	89	70	76	148	134 *	688
SCI	102	124	141	146	171	169	186	1039

*Chiffre partiel, environ 30 % des références d'une année n'étant saisies que dans le CD Rom de l'année suivante.

Les chiffres du SCI sont à couverture croissante (+ 25 % d'enregistrements dans le monde entre 1991 et 1997). En 1994-95, PASCAL perd des références parce qu'il se désabonne de nombre de Journaux (notamment édités en Afrique). La base regagne par la suite des références, parce qu'elle enregistre tous les auteurs (au lieu du 1° seulement, comme par le passé).

On peut donc dire que les deux bases s'accordent sur :
- le volume annuel (ou son ordre de grandeur : pour l'heure, 160 références annuelles).
- certaine croissance dans les 10 dernières années (principalement imputable aux sciences médicales cliniques, et secondairement aux sciences biologiques).
- le rang de classement actuel (8°, en tête du 3° Groupe Africain, d'après le SCI qui a un biais anglophone évident; 11°, mais toujours dans le 3° Groupe (mené par le Cameroun selon PASCAL, qui saisit mieux les travaux francophones).

La répartition par grands domaines est la suivante (données PASCAL) :

18% relève des sciences agricoles
59% relève des sciences médicales
23% relève des sciences exactes, expérimentales ou du génie industriel.

Le profil ressemble plutôt à celui d'un pays francophone. Il témoigne surtout de la priorité accordée par le pays (ou par les donateurs), dans un contexte de grande pauvreté, à la

recherche liée aux besoins de base (nourriture et santé). La part de sciences exactes et naturelles n'est pas ridicule. Elle tient pour large part aux sciences de la terre (géologie, hydrologie, géophysique), bien qu'on note aussi l'existence (précaire) d'une Faculté d'ingénierie de bonne réputation. La dépendance à l'égard des financements extérieurs, et l'esprit de "marché" et de "court terme", qui anime les responsables nationaux aussi bien qu'internationaux, transparaissent à travers ces orientations.

(A titre comparatif, la production se répartit comme suit entre les trois domaines selon les régions d'Afrique:)

Régions	Agriculture	Santé	Autres sciences
Afrique au nord du Sahara	9%	29%	62%
Rép d'Afrique du Sud	8%	36%	56%
Afrique anglophone au sud du Sahara, sauf Rép d'Afrique du Sud	*21%*	*48%*	*31%*
TANZANIE	**18%**	**59%**	**23%**
Afrique francophone au sud du Sahara	15%	63%	22%

2. AUTEURS.

1440 noms d'auteurs différents figurent sur ces publications.

Ratio Nbe d'auteurs / Nbe d'articles :

en moyenne : *2,4*

3,0 en sciences médicales
1,0 en sciences agricoles
1,0 en sciences physiques et de l'ingénieur

Sauf en sciences médicales, l'individualisme est de règle, et la production concentrée autour de quelques Figures.

Figures de la science : certains noms reviennent (***voir Annexe 1***).

On notera que les références datant de 1990-1997, *les auteurs qui apparaissent le mieux* sont ceux qui ont fait des travaux marquants (ou/et des contributions régulières et significatives), de 1987 à 1995 environ.

Des chercheurs intéressants peuvent être moins apparents; notamment :

certains chercheurs brillants de passage

des chercheurs actuellement importants, soit nationaux fraîchement recrutés (ce que l'ajustement structurel rend improbable); soit coopérants récemment installés.

des chercheurs actifs mais qui se préoccupent peu de publier (soit parce qu'ils se consacrent à la recherche-action, à la recherche didactique, ou parce qu'ils appartiennent à des disciplines dont le style fait moindre place aux écrits en Revues : sciences agricoles par exemple, à l'opposé des sciences médicales).

L'identification des figures ici présentées a toutefois une triple importance :

- il s'agit des auteurs qui ont récemment produit une science influente, utile pour le pays, où celui-ci peut opportunément puiser.
- l'examen de leur stabilité ou de leur turn-over, et de leur "postérité", permet de qualifier le degré et les pôles de structuration d'une communauté scientifique nationale (ou de milieux de spécialistes).
- l'examen de leurs relations scientifiques, et de leurs sujets de recherche, permet de qualifier l'espace scientifique où s'inscrit le pays.

En outre, le degré de *concentration de la production*, qu'il est possible de calculer à partir de ces données, est un indicateur important de l'état des sciences dans le pays (domaine par domaine). On retiendra notamment les chiffres suivants.

En sciences médicales , sur **1 208** noms d'auteur,

Nbe	auteurs signent chacun	Nbe de publications	% des auteurs	% des participations	% cumulé des auteurs	% cumulé des participations
6		20 et plus	0,5	5,6	0,5	5,6
23		de 10 à 19	1,9	12,9	2,4	18,5
63		de 5 à 9	5,2	16,2	7,6	34,7
124		3 ou 4	10,3	16,6	17,9	51,3
215		2 publications	17,8	17,4	35,7	68,7
777		1 seule publication	64,3	31,3	100	100
1 208			100	100		

soit :	1 % des auteurs participe pour		10 % à la production	
	5 %	d°	28 %	d°
	10 %	d°	40 %	d°
	18 %	d°	50 %	d°
	35 %	d°	66 %	d°

et : près de 2/3 des auteurs ne publie qu'une fois en 7 ans.

Très forte au départ, la concentration l'est ensuite de façon modérée. On peut y voir le signe qu'autour d'une pléiade de Figures (qui entretiennent l'impératif de production scientifique) se forment des phalanstères (dont le leader co-signe la production); chacun cherchant à intéresser un large vivier alentour, et à y puiser. On peut aussi penser que la grande flamme est limitée à ces phalanstères; et que le reste des publications est plus lié aux exigences formellement imposées par la profession pour la promotion dans son sein. Il reste que les sciences médicales sont ici les plus nourries, celles qui non seulement se maintiennent mais se développent activement.

En sciences agricoles, sur **125** auteurs :

Nbe	auteurs signent chacun	Nbe de publications	% des auteurs	% des participations	% cumulé des auteurs	% cumulé des participations
0		10 et plus				
9		5 à 9 articles	7,2	21,1	7,2	21,1
23		3 ou 4 articles	18,4	31,2	25,6	52,3
20		2 publications	16,0	16,9	41,6	69,2
73		1 seule publication	58,4	30,8	100	100
125			100	100		

soit : 2 % des auteurs participe pour 6 % à la production
7 % d° 20 % d°
11 % d° 30 % d°
25 % d° 50 % d°

et : plus de moitié des auteurs ne publie qu'une fois en 7 ans.

Le niveau de publication est faible, et la production repose sur quelques institutions (très soutenues par l'aide extérieure), et sur une poignée de figures (une douzaine publiant au moins une fois l'an). Assurément le vivier est plus large; une cinquantaine de chercheurs publient un article tous les 2 ou 3 ans. On sait que les professionnels de ces domaines publient parfois très peu. L'irrégularité de la production d'une année sur l'autre traduit toutefois l'extrême fragilité d'une communauté dépourvue de financement sûr et d'orientations propres, soumise aux vents de l'urgence, et déstructurée par la dégradation de la profession. Celle-ci est obligée de privilégier l'expertise (qui la fait vivre) sur tout programme suivi de recherche [Gaillard & Waast, 2 000].

En sciences exactes et de l'ingénieur, sur **107** auteurs :

Nbe	auteurs signent chacun	Nbe de publications	% des auteurs	% des participations	% cumulé des auteurs	% cumulé des participations
1		10 et plus	1	6	1	6
9		de 5 à 9	8	24	9	30
16		3 ou 4	15	25	24	55
16		2 publications	15	15	39	70
65		1 seule publication	61	30	100	100
107			100	100		

Les mêmes remarques faites pour les sciences agricoles valent ici, de manière aggravée. Le vivier est étroit, et la production d'un an sur l'autre fort irrégulière (avec un creux très profond en 1993-95).

3. INSTITUTIONS.

Voir Annexe 2 : Points forts et faibles : croisement des institutions et des domaines.

ANNEXE 1. Les tableaux suivants mentionnent les noms des **auteurs** les plus productifs, en chaque domaine.

Médecine et Santé

Institutions	**20 articles et +**	15 à 19 articles	*10 à 14 articles*	7 à 9 articles	5 ou 6 articles
Un Dar-es-Salam & CHU	**MCLARTY DG** (23) **SWAI ABM** (23)	MHALU FS (17); ALBERTI KGMM, BIBERFELD G, (14)	*Lyamuya EF (13); Amir H, Kilima PM, Kitinya JN, Kitange HM, Klepp KI* *(p.m. & Proj Bagamoyo : Premji,*	Mnyika KS, Kagoma C, Massele AY, Matee MIN; Killewo JZJ (& Proj Bagamoyo : Shiff, Minjas, Makemba, Winch)	Hunter DJ, Masuki G, Matuja WBP, Mlay SM, Samanarayake LP, Sayi E Shao JF, Urassa E, Bredberg-Raden, Mbena E, Mbonde MP, Mwakagile D, Ndosi NK, *Pallangyo K £*, Richter C, Rwiza HT, Sandstrom A,
AMREF	**GROSSKURTH H** (27) **TODD J** (24) **MAYAUD P** (21); **SENKORO KP** (20)	NEWELL J (18), HAYES R , KLOKKE A, MOSHA F (17); BORGDORFF MW (15)	*Ka-Gina G; Gavyole A*	Nicoll A; Gabone R	Webst B
Inst Rech Méd MWANZA	**(p.m. : Grosskurth, Todd Mayaud & Senkoro))**	BEREGE ZA (14) (p.m.: Newell, Hayes, Borgdorff)	*(p.m. : Ka-Gina, Gavyole)*	Gumodoka B,; Mkambe RJB, Munguti K, Quigley M	Jacobs L, Vos J
Inst Rech Méd AMANI		(p.m. : Klokke A, Mosha F)	*Curtis CF, Mabey D, Barongo L*	Malle LN, Mutabingwa TK; De Geus A, (p.m. Nicoll, Gabone)	Lines JD
Inst Rech Méd IFAKA		TANNER M (14)	*Smith T,*	Charlwood JD	Alonso PL, Takken W
Min Santé		(p.m. & Un DES : Alberti)	*(p.m. & Un DES : Kilima; Kitange)*	Savioli L, Albonico M	Ndekki SS, KisumkuUM (heminth), Mosha HJ, Stoltzfus RJ
Projet Bagamoyo & Univ Dar es Sal.			*Premji Z*	Shiff CJ, Minjas JN; Makemba AM; Winch PJ	Lubega P
Proj Sida Mwanza				Boerma JT	Isingo R
Hop divers			*Dolmans WMW **	Van Roosmalen J, Walraven GEL; Van Dongen PWJ* Jongen VHWM **	Ramaiya KL ***
Inst rech Nutrition					Rosling H, Svanberg U
Inst rech Palu					Rooth I
Lutte Lèpre-Tuber					Chum HJ
Inst tropical Suisse		(p.m. Tanner)			Mshinda H

*Hop divers : * = Mwanza; ** = Ndala; *** = Hop Hindu Mandal; N.B. £ = aussi Fac de sciences*

ANNEXE 1. Les tableaux suivants mentionnent les noms des **auteurs** les plus productifs, en chaque domaine.

Agriculture

Institutions	**+ de 10 articles**	7 à 10 articles	*5 ou 6 articles*	3 ou 4 articles	2 art
Un Dar Es Salaam			*Mayo AW,*	Sokol W, Waibel R; Mgiro CLC, Op den Camp HJM	
Un. Agr Sokoine		(p.m Mugasha)	*Mugula JK, Chamshama SAO, Iddi S, Teri JM (p.m Pluth)*	Mnkeni AP; Bilanski WK, Evers G, Kajuna Star, Karel EK, Lyimo EO, Maghembe, Mittal GS, Mtebe K	14
Inst Rech Forêts		MUGASHA AG	*Pluth DH*		
Inst rech agr Seli			*Karachi M,*		
Inst rech agr Ilon				Kabissa JCB; Kayumbo HY, Yarro JG	1
Inst rech agr Mosh				McNicol RJ, Nyange NE, Williamson B	2
Inst rech agr Mbeya					2
Inst rech sur le Thé				Burgess PJ, Carr MKV	
Projet allemand Selous				Creel S, Creel NM	
Min Agriculture				Martin PJ	1

Autres sciences

Institutions	**+ de 10 articles**	7 à 10 articles	*5 ou 6 articles*	3 ou 4 articles	2 art
Un Dar Es Salaam	**NJAU EC** (13)	URASSA WK (9); NKUNYA MHH (aussi Un méd)	*Lyamuya E, Mbena EC, Mhalu F, Nawe J, Scheutz F, Simon E Samaranayake LP (aussi Un méd)*	Gijzen HJ, Griffiths D, Ikingura JR, Kasule FK, Muhongo S; Foster A, Ishengoma RC, Kassenga GR, Kivaisi AK, Matee MI, Mulokozi AM, Mwinula J, *Pallangyo KP, Mbede E*	14
African Wild				Newmark WD (& Un Dar Es Sal)	

ANNEXE 2.

Domaines de prédilection des principales institutions (Détail).

Sciences agricoles (* voir Sciences de base)

Domaines\Inst	U Dar es Salaam	U Agr Sokoine	I rech nutrition	Min Agric	I rec agr Seli	I rech Forêts	I rec Mosh	I pesticid	I rec Ilon	I rec Thé	Divers Inst	Ecoles agr	Divers Proj	Divers Minist	Divers Int	Divers Bilat	Divers Privé	Total
Score global	**(306)**	**(76)**	**11**	**5**	**9**	**6**	**4**	**4**	**4**	**3**	**8**	**5**	**5**		**2**	**2**		
Agriculture	4	40		6	4	5	3	4	3	4	7	4	4		2	2		92
Sélection gén	1	3			3		2		1	2	3	2	1					18
Sc. du sol		2				1		1										4
Elevage		1									1							2
Forêts		5				3												8
IAA	4	20	4								1							29
Biotech agric	16						4											20
AGRIC																		
Entomo, Bio	*	*		*	*	*		*		*	*	*	*					*
Biblio															2			
BIBLIO																		

** Divers Projets : Dévpmt coco, Soil service; Divers Instituts = Mbeya, Nali, Horticulture, Animal diseases... ; Bilatéral : GTZ; International : ICRAF, FAO

Sciences de base et sciences de l'ingénieur. (* Voir Sciences agricoles) Privé = Cie des pétroles Tanz, Saruji; Projets : Proj allemand Selous, Service des sols, Geol Survey

Domaines\Inst	U Dar es Salaam	U Agr Sokoine	I rech Amani	I rech Ifaka	I rech nutrit.	I rec agr	I sc mer &pêche	Enviro nmt	Divers Hop	Min agric	Min Energie	Min divers	Divers Proj	Parcs Nat	Afric Wild	Divers Privé	Divers Bilat	Divers Int **	Total
Bio fondam	12	4			1	1													18
Bio animale	31	12	5	3	1	5	2		(3)	2	2	2	2	7	3		4		84
Bio végétale	3					1													4
Entomo						2													2
Géologie	47	1					1	1			8	1	6			15			80
Hydrologie	13	1					1	1			2	1	2						21
Océano	1																		1
Géophysique	18															1			19
Astro/Atmos																			
Physique géné	2																		2
Phys nucléaire																			
Plasmas																			
Chimie géné	3																		3
Chim minéral	3																		3
Chimie orga																			
Math		1																	1
Statistiques																			
SC de BASE																			
Informatique																			
Télécom	1																		1
Electronique																			
Electricité	1																		1
BTP																			
Energie	21																2		23
Génie chimiq	1	3																	4
Génie méca	8																		8
Manutention																			
Matériaux																			
Pollution	6							3											9
Sc Ingénieur																			
SC TOTAL																			

Domaines de prédilection des principales institutions (Détail) : Sciences médicales

£ voir Sc de base; Min Santé = dont Ecoles, Instituts (Santé pub : 1...) & Directions régionales * Divers Hop : Ndala(7), Dodoma (7), St Francis(5), Hindu (4) et 21 Centres ou Hop régionaux. ** Divers Projets : dont Palu (4), Tuberculose/Lèpre (3), Reproduction humaine (3)... *** Bilat : Inst Suisse (4), Inst anglais (4), GTZ, USAID...Internat : OMS

Domaines\Inst	U Dar es Salaam	U Agr Sokoine	I rech Amani	I rech Ifaka	IR&Hop Mwanza	I rech nutrition	Min Santé	C méd Chris	AMREF	Divers Hop *	Pj Bagamo	Pg Sida	Divers PG	Divers Intern	Divers Bilatéra	Assoc & Fdations	Total
Score global	**(306)**	**(76)**	**36**	**20**	**35**	**10**	**32**	**15**	**10**	**44**	**7**	**6**	**23**	**1**	**11**	**5**	
Bactérioses	11	4	3		1		2			6			4				31
Parasitoses	12	2	13	9	3		5	1		5	6		5		6		67
Viroses & Myc	3				2				1	1			2	1			10
Entomo méd	1	3	6	8			3			1	1				1		24
Bio an & fonda	£									2					1		£
Métabol/Nutrit	2							1		1						1	5
BIO MED																	
Hémato					2		1			3						1	7
Cancer																	
Immunologie	28		4		9		5	2	5	2		3	1				59
Endocrino	10						1			2							13
Rhumato	1									1							2
Santé publique	19	3			3	5	7		1	1	1	2	3		1	2	48
Radiologie	4							3		1			1	1			10
Gynéco-Obst	16				9		3			3			1				32
Anesth-Réa					2			1									3
Chirurgie	3						1			6							10
Gastro	5																5
Cardio	4						1			1							6
Méd tropicale	134	7	28	12	28	3	26	10	5	41	6	3	17		7	4	331
PharmacoTox	32	2	7	3	1	2	4	3		7			2		2	2	67
Psycho	5				1		1	1	1			1	1				11
ORL	4						3										7
Dermato/MST	11		2		1		1	2	2	3							22
Néphro	3									2							5
Neuro	7									2							9
Ophtalmo	1																1
Pneumo																	
SC. MED	316	21	63	32	62	10	64	24	15	91	14	9	37	2	16	10	