In the Field

An Assessment of Animal Health Projects: U.S. Agency for International Development, 1960-93[1]

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ABSTRACT What are the more significant broad-based needs of animal health programs in developing countries? Essentially they are: health management programs, delivery systems, disease surveillance and monitoring of livestock movements, and improved technologies that are cost-effective and environmentally sound.

Responsible program planning elicits important considerations that strengthen final results if integrated early into project design. Examples of these considerations include

- *the potential for intervention;*
- *producers' requirements for animal health services;*
- *present and future effect(s) of disease;*
- *trends in livestock production and marketing;*
- *affect of improved animal health technology on traditional production practices;*
- *recurrent costs; and*
- *affect of government policies on development and application of the technology.*

For what reasons do some project activities need to be redirected or continually sustained with donor support? A review of the case studies reveals that five major factors critically impact on project longevity. They are 1) initial expense and recurrent costs, 2) labor required, 3) long-term effectiveness, 4) difficulty in achieving objectives, and 5) government policies or civil strife.

The U. S. Agency for International Development (USAID) has funded animal health projects for 30 years. Unlike most other bilateral projects, nearly one-third have continued for at least a decade. Given the nature of the biological cycle of livestock, animal health projects and programs require long-term commitments. USAID's investments in animal health projects continue to pay dividends despite continuously changing global political priorities and the redefining of development issues.

Introduction

In developing countries, animal health technologies — and donor-funded programs that introduce or promote them — are critically important to increasing livestock productivity. However, financing recurrent government expenditures for such programs continues to be a problem for countries where cost recovery for animal health services is crucial to their sustainability (Anteneh, 1985a; de Haan and Bekure, 1991).

Financing animal health services in many countries has yet to reach a level considered appropriate for adequate protection against the most serious livestock diseases (Anteneh, 1983). Thus, the United States Agency for International Development (USAID) remains interested in providing funding for research with the expectation that marketing healthier livestock

will generate economic growth for developing countries

With brief descriptions of three case studies, this paper assesses USAID-funded animal health projects and describes why some have been successful while others have met with difficulties. It also describes USAID's support for multidonor disease eradication campaigns, and describes how some policies impede improving the status of animal health in developing countries.

Examining these case studies will show that new technologies can, and sometimes do, improve the lives of producers and consumers. But transferring technology is challenging. A new technology often creates higher expectations among producers and sometimes fosters economic or other dependencies that prove to be disadvantageous. For example, introducing exotic breeds of cattle with lower tolerance to parasites in the tropics often requires frequent dipping or spraying to control ticks, and subsequently increases the cost of livestock production.

Technologies that are more difficult to transfer due to cost, requirements for labor, or level of sophistication discourage donors and may lead them to shift support to other development activities.

Yet ever-increasing exigencies in animal health continue to multiply throughout developing countries, juxtaposing against other development sectors such as economic sectoral adjustment or population and human health issues. In the development business, activities can become fads and fads rapidly fade. Today's new and exciting technology is surpassed by tomorrow's more pressing human need. But in terms of animal health, the same problems continue to repress productivity in this century as they have in the last.

Animal health needs continue to grow throughout the developing world, but with increased competition for fewer dollars, there is a danger that the needs of agriculture and animal health will be neglected.

Methods

A close review of available USAID documents illustrates that USAID has funded approximately 27 discrete animal health projects since 1960, the majority of them in Africa (Table 1). These projects can be categorized as follows: basic and applied research, disease surveys, herd health programs, animal health delivery systems, infrastructure, USAID-supported studies and regional parasite control (Table 2). About 50% of USAID's funding has been allocated to U. S. universities or other contractors, and 50% to other donors, international centers, or bilateral programs to design and implement these projects.

Animal health is strongly correlated with management. Improved management increases productivity by reducing disease and parasite infestations, and by improving animal nutrition. In this paper, animal health projects refer to those that focus specifically on prevention or control of disease and parasites, and not on general livestock production projects with minor elements of animal health.

Further, in examining the USAID experience with transferring animal health technologies, this paper will only consider those projects in which USAID was the main, or sole donor agency. Multidonor funded institutions, such as ILRAD and ILCA, and multi-country eradication programs, such as the Pan African Rinderpest Campaign (PARC), will be excluded. This exclusion is an acknowledgment that many of the problems faced by such research institutions and programs are due to problems of effective coordination among the multitude of parties involved. As such, these problems require a separate study.

Table 1. Trends in Numbers of USAID Animal Health Projects (1960-1993).

No. Projects Funded*	Decade
4	1960-69
9	1970-79
12	1980-89
2	1990-present

* excludes ILRAD and ILCA programs

Analysis

To examine which USAID-funded animal health projects have been considered successful and why, the following criteria will be used:

1) Did the project improve animal productivity and create visible economic development?
2) Was there potential for intervention before the project was introduced, creating a need for the technology?
3) Was the project appropriate culturally, environmentally, systematically, and economically?
4) Did producers "buy in" to the project thereby effecting technology transfer among themselves?
5) Would government policies support project activities and adaptation of technologies after donor funding terminated?

Although sufficient documentation is unavailable to critically analyze most of the projects listed in Table 2, information for three case studies is available. These projects will be described in terms of purpose, continuity, project site, successes, and difficulties. They are

- Small Ruminant CRSP (Kenya animal health component);
- Niger Integrated Livestock Production; and
- Mali Livestock Sector Program (Phases I, II, and Animal Productivity and Export Project).

Table 2. USAID Animal Health Projects (1960-97).

Basic and applied research:
Small Ruminant Collaborative Research Support Program * (SR-CRSP) — Africa (1978-present)
Heartwater Research Project — Africa (1984-present)
Research on Animal Diseases (ILRAD) — Africa (1968-present)
Research on Hemoprotozoal Diseases — S. America (1968-79)
Control of Hemoprotozoal Disease — S. America (1975-80)
Tsetse Fly-Trypanosomiasis Research and Training — Africa (1976-83)
Mali Livestock Sector II — Africa (1975-84) *
Physiology and Ecology of Ticks — Africa (1978-83)
Host Resistance-Integrated Tick Control — Africa (1983-88)
Mali Livestock Sector III — Africa (1982-92)*
Niger Integrated Livestock Production — Africa — (1983-90) *
Improved Animal Vaccines through Biotechnology (1986-present)
Phase I - rinderpest vaccine
Phase II - anaplasmosis/babesiosis vaccine
Disease surveys — Africa
Mauritania Rural Development (1975-83)
Somalia Central Rangeland Development (1979-89)
Niger (1981)
Herd health programs:
Livestock Production in the Tropics (1972-77)
Antigua Livestock Improvement (1984-87)
Delivery systems — Africa
Mali Livestock Sector III (1982-92)
Niger Integrated Livestock Production (1983-90)
Mali Animal Productivity and Export (1992-97) *
Infrastructure — Africa
Faculty of Agriculture and Veterinary Medicine, Ahmadu Bello University, Nigeria (1968-74)
Central Veterinary Laboratory, Mali (1963-77)
Somalia Livestock Marketing and Health (1984-91)
New World Screwworm Eradication for North Africa (1990-94)
A.I.D.-supported studies (ILCA and ILRAD) — Africa (1975-present)
Parasite Control:
Belize Livestock Development Phase II (1983-92)
Regional Bont Tick Eradication (1987-91)
Multi-donor Disease Eradication Campaigns
JP15 Rinderpest Campaign (1962-76)
Pan-African Rinderpest Campaign (1984-87)
New World Screwworm Eradication Programme (1988-92)

* Case studies

Brief Description of Case Studies

I. Small Ruminant CRSP (Kenya Animal Health Component)

As part of a larger collaborative research program, Washington State University received a subgrant from the SR-CRSP to conduct animal health research in Kenya. Subcontracting to Colorado State (which was forced to leave Peru when political strife interrupted the SR-CRSP program there), WSU and CSU scientists focus their research on vaccine development for Nairobi sheep disease, Rift Valley fever, and the common stomach worm, *Haemonchus contortus.*

Although the main thrust of animal health research in Kenya originally focused on goats (primarily because the SR-CRSP was synthesizing the Dual Purpose Goat or DPG breed), current research includes sheep and focuses on regional diseases of both species. To date, the SR-CRSP/Kenya has developed a caprine arthritis encephalitis diagnostic; has developed and is ready to test a recombinant vaccine that contains the Rift valley fever virus gene; and has identified and

cloned genes of infectious agents that encode immunoprotective proteins.

Acclaimed success came to the SR-CRSP with its development of a monovalent vaccine for contagious caprine pleuropneumonia (CCPP). CCPP is an acute or chronic contagious disease of goats caused by a pneumonia-like group of organisms. It is widespread in many countries in Europe, Asia minor, and the Mediterranean littoral, and in Russia, China, Africa, India, Burma, Assam, and the Malay states. For acute cases, mortality rates of 60-100% and sudden deaths are by no means uncommon. Treatment with antibiotics can give good results, but where the disease is endemic, control can be attempted only on a herd basis.

In recent discussions with the Government of Kenya (GOK), USAID learned that the GOK exercises a policy that classifies CCPP among the diseases for which the Government provides free vaccines. It's not clear when this policy was established — before or after vaccine research commenced — and it may be, in reality, why the vaccine has not been integrated commercially into the national disease prevention and control system. So although the primary objective of USAID's funded research had been accomplished (*i.e.*, vaccine development), its secondary objective — commercializing the research product — conflicts with the government's policy that the CCPP vaccine be provided *gratis* as part of the GOK's mandate of disease control.

Here is a technology that is needed, applicable worldwide, improves animal productivity, is appropriate to various production systems, and enhances economic development of producers. In a recent impact assessment, Lipner and Brown (Figure 1, 1993) illustrates that CCPP is endemic in a large area of Kenya. From the information garnered, the report shows that the disease is more widespread than recognized by the Government of Kenya, although it was most likely underreported. With that misunderstanding, and the fact that at least two other entities in the Government are involved in commercial vaccine manufacturing, it has been a time-consuming and sometimes difficult process to move CCPP vaccine off the shelf and into producers' hands in as large quantities as are needed on the farms. But in spite of demand by local producers, the CCPP vaccine remains uncommercialized.

Even though healthier animals are more productive than sickly ones, it would be erroneous to assume that farmers would raise greater numbers of goats were the CCPP vaccine easily available.

In Kenya's intensive production system, where goats are usually tethered on the farms, environmental impact is greatly minimized. To continuously perpetuate the myth that goats indiscriminately destroy the environment highlights the high level of public ignorance about a species that selectively browses for its food.

In spite of the domestic, export, and economic demands for the CCPP vaccine, other factors specific to CCPP and Kenya's more general system of animal health care delivery limit its integration into the national delivery system. Inoperative or inadequate equipment and a lengthy (one month) processing time limits supply. Production costs and actual need have not been determined. Financial constraints of the Kenya Government (primary purchaser of the manufacturer's vaccines) limit the manufacturer's ability to access operating capital.

Like a falling domino this funding shortage limits purchase of inputs needed to prepare the vaccine, maintain equipment, pay salaries of delivery personnel, and it impedes disease control activities. Other contagious disease outbreaks, such as foot-and-mouth disease, often take priority over scheduled preventive vaccination campaigns. Without donor funding, such campaigns are unsustainable. Limited national budgets also reduce the GOK's ability to conduct effective disease surveillance, and without such information, the true level of disease prevalence remains unknown.

CCPP is prevalent worldwide, although the viral strain differs slightly in other regions. However, with little difficulty, CCPP vaccine can be processed to be effective against these strains. SR-CRSP scientists have already transferred the vaccine technology to Mali where they have trained Malian scientists in the national laboratory to manufacture the vaccine for their use.

II. Niger Integrated Livestock Production

Among six major components of an integrated livestock project designed to increase livestock productivity in Niger's pastoral zone, animal health remained a primary focus as the project evolved. To achieve a higher level of economic development among Nigerien herders, the project proposed creating an institutional structure in the pastoral zone that would allow herders to play a substantial role in mobilizing the resources and services necessary to increase productivity and develop the pastoral zone. Herder associations served as the institutional structure through which pilot activities were undertaken, such as testing vaccine efficacy, feed supplementation, and conducting trials to determine the effectiveness of certain drugs. However, drought, socioeconomic constraints, and internal politics inhibited the creation of the proposed number of herder associations.

In Phase One of the project, the animal health component conducted a number of field trials to test the efficacy of vaccines produced by the National Laboratory, feed supplements during the dry season to improve animal productivity, and to determine the efficacy of treatments for bacterial diseases or parasites. In addition, the project built five portable vaccination chutes for use by the Livestock Service, trained

15 veterinary technicians, collected field data on disease, and established, equipped and stocked a branch of the National Livestock Laboratory.

To establish an effective, low-cost veterinary health care delivery system, Tufts University trained fifty-five volunteer veterinary auxiliaries for each herder association. Acting as liaisons between the associations and the Government of Niger's Livestock Service, and trained in herd health and preventive medicine, these auxiliaries treated a few easily diagnosable conditions and reported outbreaks of disease.

Among the major diseases reported were rinderpest, peste de petit ruminant (PPR), sheep pox, caprine arthritis-encephalitis and maedi-visna virus infections, and Rift Valley fever in camels. Because the auxiliaries were volunteers, this activity attempted to establish routine veterinary health care as an integral part of herd management, and to reduce herders' dependencies on the government's services. In addition, Livestock Service personnel hopefully would become more effective, and reach a greater number of beneficiaries.

At the end of the first phase in mid-1986, field trials terminated and the animal health activities moved to the National Laboratory in the capital city. Phase two of the project concentrated on training animal health technicians in epidemiology, diagnostic techniques, and microbiology. Veterinary auxiliaries who were taught to recognize disease patterns in small ruminants and camels established an early epidemiological warning system. And three Nigerien staff of the Livestock Service learned vaccine production and related laboratory procedures and diagnostic tests in short-term training in the U. S.

Although training remained a primary activity of the project in Phase Two, collaborative research continued between the National Laboratory and the USDA to develop a thermostable rinderpest vaccine. In Africa and throughout the world, rinderpest remains a major disease affecting cattle and buffalo. But the real cost remains the control of the disease, and not direct losses due to the disease itself. At the time of the project, the Plowright rinderpest vaccine required continuous refrigeration until the time of use. Recurrent costs for continued purchase of this vaccine and the need for the cold chain limited the effectiveness of the Government of Niger's Livestock Service.

Basing their research on conventional methods with little reliance on genetic engineering, Tufts and the USDA first examined the means of vaccine production with a goal of producing better stabilization of the final product. Secondly, scientists developed a strain of the virus that was inherently more stable at higher temperatures than the strain in current use. The economic value of the new vaccine includes a reduction in the recurrent costs of the delivery system estimated to be $3.6 million *per* year, greater confidence in delivery of effective vaccine to remote areas, and a suitable vaccine for delivery to politically volatile areas where the cold chain cannot be supervised.

Unfortunately, early termination of the project did not permit complete animal testing of these strains. It was not until 1993 that USAID again agreed to fund this important activity, but only for one year. Confined trials will begin in Kenya in February 1994 to determine the efficacy and longevity of the new vaccine.

III. Mali Livestock Sector Program (Phases I, II, and Animal Productivity and Export Project)

Recognizing the potential represented by livestock as an important vehicle for stimulating economic development, USAID initially funded a regional project to research, produce, and supply vaccine for Sahelian herds in 1962. Originally titled the Livestock Production and Marketing Project, it incorporated into its scope several activities for which funding had terminated. From 1974 the livestock program evolved and expanded into what was fundamentally a sector-level effort comprised of four major components:

- assistance to the Central Veterinary Laboratory (CVL);
- commercialization of livestock through increased production and marketing;
- tsetse fly and trypanosomiasis research; and
- post-drought herd recovery assistance.

Since the 1960s, the Mali Livestock Sector Project has been refined to work more closely with and to address the Government's animal health policies. This elaborate project has evolved from one ambitiously focused on numerous activities, to one more narrowly and realistically focused on animal disease control and prevention. Earlier activities included livestock fattening, veterinary services, range management, clearing tsetse-infested land, training extension workers, testing improved herd management techniques and traditional animal health practices, and providing producer credit. Such an ambitious project could not be sustained for long due to its recurrent costs, conflict with government policies, and apparent fluctuating interest on the part of USAID Ultimately it focused on animal health.

During the period 1961-63, loans from USAID and other donors provided for the construction of a modern laboratory facility, the Central Veterinary Laboratory. Then subsequent grants from AID funded technical assistance, training, and commodity support, which continued without interruption for 17 years. A direct grant to Texas A&M University supported part of the Tsetse Fly Control Program.

The project was amended several times to reorganize activities to implement/upgrade a disease diagnostic network, and disease monitoring and drug/vaccine distribution systems, and to support privatization of veterinary services and improvements in animal

health care delivery by both private and public sectors (Experience Incorporated, 1979; Annual Report, 1992; Non-Federal Audit, 1989; Audit Report, 1980; WSU Collaborator Group, 1992). Animal health activities have been redefined and narrowed in focus. The project continues in a third phase (see Appendix: Mali Case Study).

Mali II

The Mali Livestock project has survived numerous changes in the USAID personnel managing it from Mali and Washington, DC. Mali Livestock Sector II (planned to start in 1975) also continued the effort to expand the capabilities of the CVL to include an animal disease diagnostic and investigation unit. Several objectives focused on investigating the insect and vector-borne hemoprotozoal diseases that limit livestock production in the project area. Implementation included determining the incidence and/or prevalence of trypanosomiasis and other vector-borne hemoprotozoal parasitic diseases of cattle, conducting studies on ticks and biting flies to determine their relationship to the incidence of the vector-borne diseases, and testing prophylactic treatments of cattle for trypanosomiasis.

Six years later evaluators determined the tsetse control program to be conceptually weak at its outset, citing the uncertainty that trypanosomiasis was a severely limiting factor in the project areas. Noting the large herds of Zebu cattle in the area during the "high tsetse period" led evaluators to suggest that judicious husbandry of these susceptible animals evaded riverine tsetse, which, in any case, were not considered to be the most important vectors of cattle trypanosomiasis. (However, one evaluator later expressed a conflicting view stating that the relative importance of riverine tsetse was underestimated — they readily functioned as vectors of one form of the trypanosome parasite, and were important because they were so widespread and found near waterholes.) Project evaluators noted that before a comprehensive control program was initiated, it would be wise to make a diagnostic survey, as diagnoses without validation was not a satisfactory base for embarking on a comprehensive tsetse eradication program.

Because the Malian government placed significant emphasis on eradication of the tsetse fly, it appeared that less thought was given to the costs involved, ecological consequences, and the contribution of other diseases to cattle mortality than to long-term effects. Inadequate disease diagnosis led to the determination that tsetse eradication was the panacea for cattle production problems.

In addition, these tsetse research activities were in danger of overlapping with other facets of the program. Redirecting these efforts toward studies on the presence and transmission of all arthropod-associated pathogens of Malian livestock resolved the confusion of two projects (one authorized by AID/W and the other by USAID/Bamako) conducting surveys in the same area at the same time under the auspices of the Ministry of Rural Development.

Unfortunately, while a trypano-tolerant/trypanosensitive cattle test was planned, it was slow to start and beset with considerable confusion and mismanagement. Insufficient financial, equipment, and personnel support of CVL infrastructure complicated project plans. Finally, no provision in the extension of Mali Livestock II was given to finance a tsetse control program.

APEX

By 1989 USAID had obligated $23 million to finance phase II, which was finally initiated in 1982 and scheduled for completion in 1991. Representatives of the Malian government, USAID/Mali, and the university contractor subsequently met to update technical assistance needs, identify needs for the design of the phase III Animal Productivity and Export Project (APEX), and agree on an overall strategy and approach of that project.

In that meeting, collaborators determined that short-term technical assistance in animal health should center on training CVL staff in developing technical capacity in clinical chemistry and hematology to support its diagnostic program, virology laboratory skills and techniques, and on developing improved diagnostic techniques in immunology. APEX activities, having commenced in 1992, support public sector decentralization and private sector development. Evolutionary in its approach, APEX addresses current economic policies of the Government of Mali, policies that aim to build individual capacity in Mali's rural population.

Although the purpose of APEX is to increase and sustain livestock productivity and income generated from such production, specific animal health activities endeavor to integrate public and private sector veterinary services. In this regard, 1993 workplans include but are not limited to:

- training local veterinarians in managing private practices;
- disease diagnosis training by CVL for private veterinarians and producers;
- a feasibility study for operating a vaccination park in support of improved land-use policies; and
- policy dialogues regarding public and private sector roles m regulatory veterinary medicine (epidemiology, serosurveillance, *etc.*).

In addition, CVL is targeted to improve the efficiency of its vaccine production and marketing so it can recover a greater percentage of its operating costs. Because producers are quite willing to pay for animal health services, cost recovery is significant to enable

the CVL to reduce its financial burden and sustain its services independent of donor funding.

Lessons from the Case Studies

Numerous government policies impede or stimulate the potential and use of new animal health technologies. Land tenure, supply restriction, classification of diseases, and biotechnology are some of the policies that can generate or inhibit economic growth in this sector.

As the SR-CRSP case study reveals, several government policies have limited the use of the CCPP vaccine in Kenya to date. To develop a new technology, such as a vaccine, requires highly sophisticated biological research. But to introduce this technology in a developing country demands significant socioeconomic research to address user priorities or constraints, problems associated with current patterns of use, and to accommodate a government's policy on treating livestock diseases.

In most cases, the means exist for treating or preventing diseases, parasites, or nutritional deficiencies, but sociopolitical, cultural, economic, or policy conditions preclude adequate application of available measures or products to assure optimal animal health. In Niger, timely availability, quality, cost, distribution, and proper application of prophylactics, therapeutic agents, and nutritional supplements determine the levels of livestock health and productivity in the extensive production system.

Those policies that restrict availability of vaccines, medicines, equipment, and supplies inhibit effective delivery systems. Kenya, Mali, and Niger exemplify how in many developing countries effective delivery systems remain an exception rather than a rule. However, in sub-Saharan Africa, policy dialogues since the mid-1980s have engendered greater support among senior government officials and producers for private veterinary services. To relieve supply restriction, the Government of Mali has privatized its veterinary service, thus paving the way for more equitable distribution of animal health therapeutics.

In both Niger and Mali, land tenure policies for animal-based systems (found throughout sub-Saharan Africa) encourage overstocking on communal or marginal lands, thus exacerbating unsustainable production systems. Policies that favor land ownership indirectly promote the use of improved animal health technologies, as producers are more inclined to invest in practices that return even a marginal profit on their investment (Curry, 1992). Yet, the Niger Livestock Project demonstrated how the development of a veterinary auxiliary network that receives training and supplies from government services, can provide pastoral groups with the services of a veterinary technician. Such technicians move with the groups, and give treatments and prophylaxes at the appropriate times without disturbing the pastoral system.

Like tributaries that feed a river, livestock from the pastoral systems in Mali and Niger supply a large market in the Ivory Coast. New or improved animal health technologies expand opportunities for livestock trade among developing countries, and between developing and developed ones. Yet policies that impact on trade and pricing for meat and foreign exchange usually favor domestic urban consumers, and reduce returns to livestock owners both through lower prices and higher marketing costs. Trade becomes a trade-off. Increased numbers of healthier animals supply increasing (urban consumer) demands for red meat so that market prices decline while producers' costs rise.

In general, the value of animals relates closely to the value of animal health. Efficient production optimally reduces the impact of disease and increases the potential of new technologies.

Future Policy Concerns: Biotechnology and Intellectual Property Rights

Just as the business of development evolves, so too do the types of animal health projects funded by USAID More recently USAID has supported cutting-edge research in animal health biotechnology. Several projects focus on vaccine development, both monovalent and recombinant, and include training of counterparts so that technology transfer occurs among highly-qualified, well-trained scientists as well as to producers.

With an emphasis on commercializing products researched and developed with USAID funding, project implementors and USAID personnel must be knowledgeable about intellectual property rights, biosafety issues, and ethics. As USAID enters this new era of development, biotechnology projects dictate policy issues for both the United States and countries in which USAID programs operate.

Policy issues relate to both USAID and its client countries, especially in terms of biosafety and intellectual property rights, Responsible regulatory policies for genetically engineered products are critical to the transfer and application of such technologies, but like conventional research, these countries often lack the necessary infrastructure, trained personnel, and finances to support such a development. In addition, the export of genetically engineered animal products from the U. S. requires approval by the Animal and Plant Health Inspection Service, U. S. Department of Agriculture (USDA/APHIS).

USAID is working with its client countries to establish and implement biosafety committees that can address the regulatory issues in a manner similar to and in agreement with USDA/APHIS. USAID itself has established a working biosafety group that determines whether biotechnology projects meet the requirements set forth by the Agency before projects are approved

for continued funding.

Conclusion

Because the present status of the livestock industry in developing countries demands an evolution of animal health services beyond the capability of the public sector, developing new technologies can be limited by numerous constraints. Such constraints include marginal government policies, requirements of the technology in terms of cost, labor, and time, and the appropriateness of the technology.

And as Dr. John S. Wafula, Assistant Director for Animal Health, Kenya Agriculture Research Institute, has summarized, "Major constraints to the development effort in animal health in many African countries relate to inadequate infrastructure, shortage of well-trained manpower, and limited financial support for research. These call for increased education and training of research personnel and the public in matters concerning animal health research, and disease epidemiology, detection and management; continued development of infrastructural support; and strengthening national and international collaboration in research through which technology development, transfer, and application to the nations' unique problems can be facilitated." (Wafula, 1993. KARI: pers. comm.)

Numerous reasons cause apparent disinterest or lack of producer cooperation in adopting technologies. Often improvements create high expectations that cannot be met. Producers' attitudes and values toward livestock, disease and health, traditional vs. improved technologies, and toward government services (fee vs. free) hinder technology adoption rates. Gender roles, level of education, and the appropriateness of the technology to the culture, environment, and production system, weave a complex web that entangles new technologies.

Notes

1. This paper reflects the views of the author and not necessarily those of the U.S. Agency for International Development.

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