INNOVATION, USER PARTICIPATION, AND FOREST ENERGY DEVELOPMENT

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DEFINITIONS

LS = SUDANESE POUNDS
LS 1.30-3.30 = $ 1.00 (official value, 1982-1985)
LS 1.80-5.00 = $ 1.00 (parallel market value, 1982-1985)

1 FEDDAN = 0.42 HECTARES (approximately 1 acre)

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SUMMARY

The thesis examines the process of technical change in industrialized and developing country situations, and extracts lessons from this analysis for the design and implementation of forest energy development programmes. It notes how the role of technology users is of great importance in innovation, whether this process involves “high technology” development in large, competitive firms, or “appropriate technology” development to meet basic needs in poor, rural communities. In reviewing the results of the past ten years of work in renewable energy programmes in developing nations, it finds that a major factor in the poor performance of such work is the lack of provision for user participation in innovation. Forest energy development programmes, which have been an important part of renewable energy development assistance, also have suffered from this insufficient attention to technology users. It is postulated that new approaches to forest energy development that provide for a more interactive relationship between R & D establishments and technology users will have greater success in bringing about innovations in this sector. The experience of charcoal production, charcoal stove, and forestry development under the Sudan Renewable Energy Project, supported by the Sudan Energy Research Council and the US Agency for International Development, demonstrates the positive results of just this sort of interactive innovation strategy. The SREP, in its *a priori* commitment to user participation, uncovers valuable resources of indigenous technical knowledge and skills, which play an integral part in the design and dissemination of these 3 forest energy technologies. The project’s success provides an empirical justification of the importance of technology users to the innovation process, and its example has larger implications for renewable energy development, government R & D management, and development assistance policy.

FIGURE 2.1 Linear Innovation

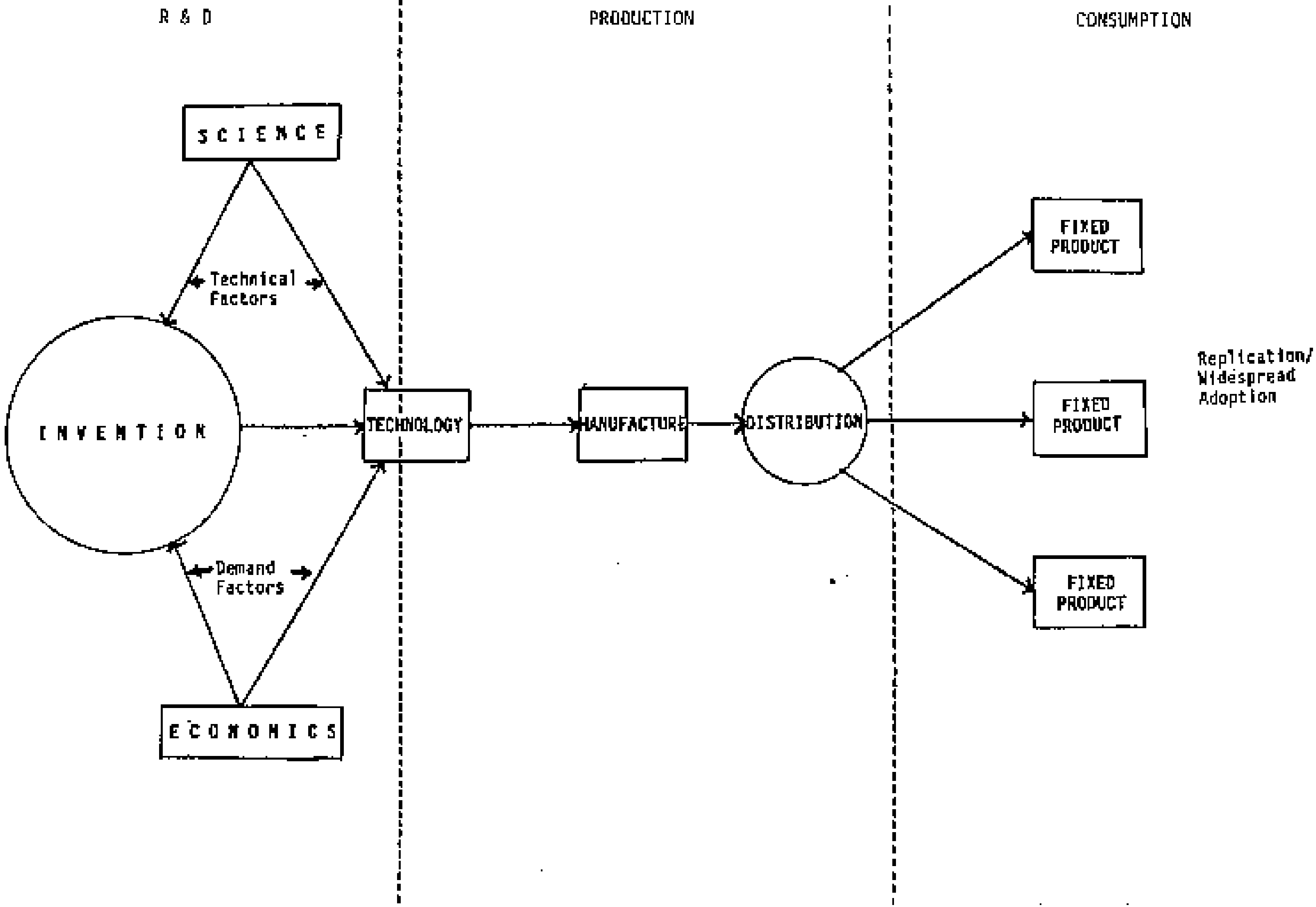
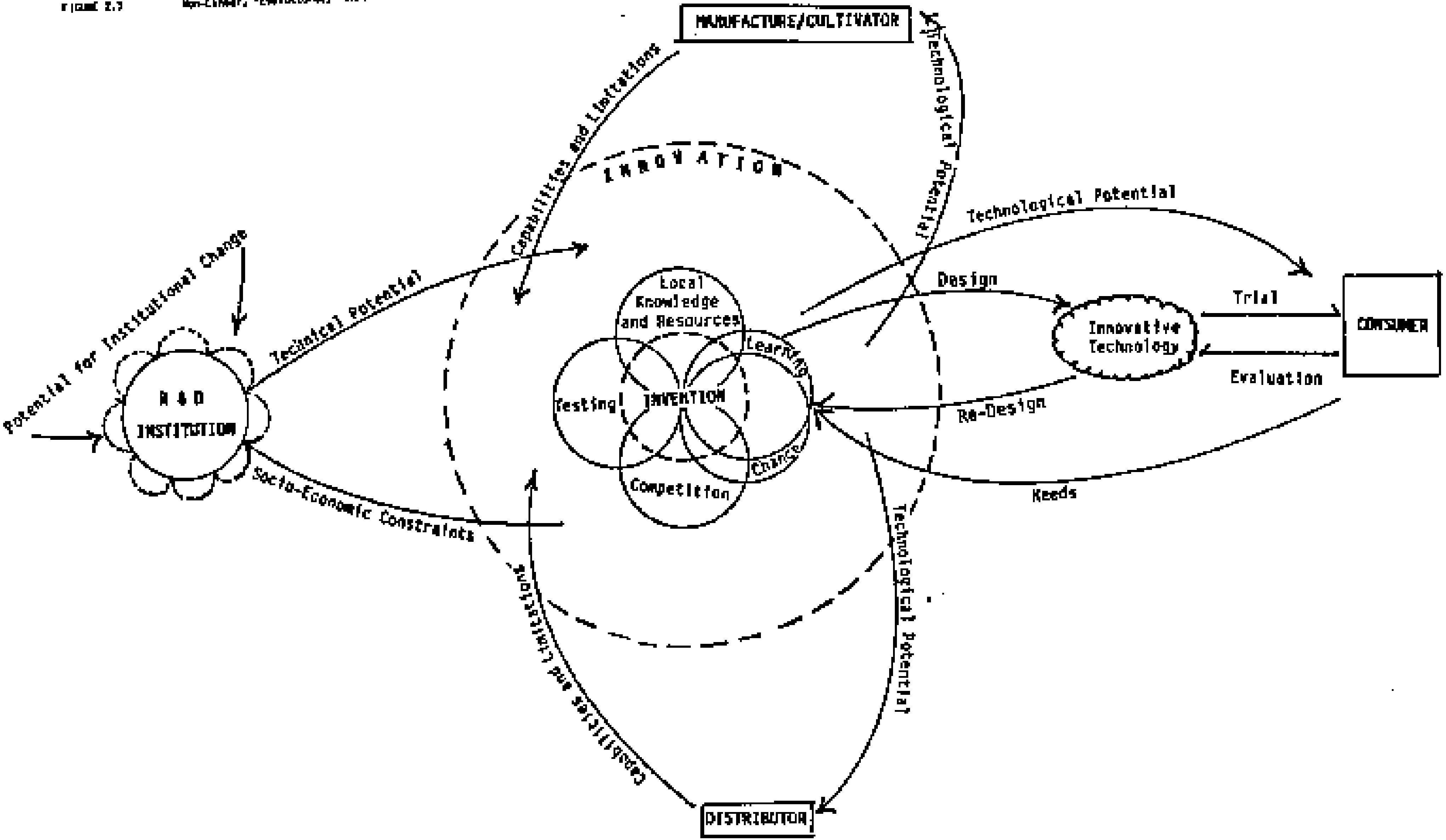


FIGURE 2.7 Non-Linear, "Evolutionary" Innovation



8. INNOVATION AND FOREST ENERGY IN SUDAN THE INSTITUTIONAL IMPLICATIONS OF THIS TECHNOLOGY DEVELOPMENT EXPERIENCE

Introduction

This chapter considers the overall forest energy development experience in Sudan in light of the earlier discussion of innovation, technology, and development. It examines how the Sudanese experience demonstrates the importance of user involvement in technical change, and of technology management policies that encourage user inputs to the design process. It also discusses the importance of the ERC's decision, in recognition of these important factors, to modify its organizational structure and R & D approach to accommodate a more user-interactive technology development strategy.

The Sudanese experience has wider implications for the role of R & D institutions in promoting innovation. In the Sudanese national context, it provides new, more user-oriented strategies for promoting technical change in the charcoal production, charcoal stoves, and forestry areas. From an international standpoint, this experience offers insights into how developing country government institutions can adopt new, more productive roles in the management of technical change. Also, it points to ways in which development assistance programmes can be structured to encourage these desired institutional transformations.

The Importance of Users in the Innovation Process

Technology users played an important role in the development of all the forest energy systems described in previous chapters. While no new kiln, stove, or tree planting technique originated from user ideas, as in the cases of user innovation in the scientific instrument and other sectors analyzed by Von Hippel, user inputs significantly affected the ultimate designs and distribution methods selected for wider support and promotion by the Energy Research Council. Moreover, several distinct types of technology users contributed to this design and dissemination process.

Users as consumers

Consumers, the group identified with “use” in its narrowest sense, provided information on technology performance that assisted in determining design directions. Women users, both cooks in households and the student researchers from Ahfad College, raised the important issues of charcoal quality decline and metal stove portability and versatility that gave the University of Khartoum engineer his initial guidance in developing new stove prototypes. Their early inputs set the design process on a sound footing, and the eventual models manufactured received a strong positive reception at market demonstrations.

Individual farmers played a key role in determining what forms of established forestry technology options would be advanced in farm and community forestry projects. They indicated which species should be raised in local nurseries, and what types of shade, shelter, and fuelwood plantings were desired under their particular social, economic, and environmental conditions. Those projects that showed the greatest response to these local suggestions also demonstrated the best progress over the relatively short (in forestry terms) span of SREP's lifetime.

Users as producers/cultivators

The SREP experience revealed other types of technology users as equally important players in the process of technical change. The manufacturing and farming sectors, which used the new technologies in their production systems, had a major influence on their design and successful development. This was clearest in the case of improved charcoal stoves, in which traditional stovemakers took the promising but somewhat impractical design ideas from the R & D work at the University of Khartoum and transformed them into easily-produced and affordable stoves for widespread household use. The ERC, in bringing the artisans into the innovation process, in turn transformed its stoves programme from a limited field testing of prototypes into a nation-wide incorporation of new designs into traditional production operations.

Forestry technology development, too, expanded its horizons through bringing producers into the innovation process. Through encouraging agricultural schemes, communities, and individual farmers to begin nurseries, it enlisted the support of agricultural know-how and infrastructure for afforestation measures. Farm and community nurseries provided trees to be incorporated into larger agricultural efforts, expanding forestry activities beyond the limited and rapidly decreasing areas of reserves. Farmer-controlled nurseries contained new ideas about species selection and intercropping options, raising ornamental plants and high-value crops such as karkadeh in situations where Central Forestry Administration facilities would only have raised timber trees, providing important and immediate financial support and encouragement to forestry operations.

Traditional charcoal kiln operators, too, played a key role in innovations in that technology area. While the ERC decided not to pursue its initial programme ideas on kiln modification, due to the high efficiencies found for traditional practices, it incorporated these technology users into its new plans for introducing charcoal production onto large mechanized farming schemes. Without the skills of the kiln operators it would not have been possible to extend charcoal production operations into the vast lands cleared each year by these schemes.

Users as distributors

Technology distributors, users in the sense that they employ a technology in a transfer process that provides their livelihood, also played an important part in the forest energy development in Sudan. The improved charcoal stoves programme depended on the contribution of existing wholesalers and retailers for both production and sales expansion. The artisans were encouraged to market the new stoves through the same channels they utilized for traditional models, with the ERC making no investment in transport or distribution assistance. This strategy quickly established a thriving, self-sustaining production and sales system in Khartoum and other urban zones. Wider market penetration, as the marketing expert's evaluation indicated, would depend on achieving an even greater understanding and involvement of this distribution sector.

The traditional system for distributing stove-making skills also was tapped by the ERC innovation strategy. Rather than having its engineers hold training sessions, the ERC hired the most skilful artisans to raise the abilities of fellow craftsmen, utulizing the traditional apprentice training methods that had successfully passed on manufacturing techniques for numerous simple metal products in Sudan. The artisan trainers were able to convey key elements of production and design factors concerning the new stoves quickly and accurately, for they understood the capabilities and concerns of their fellow stove makers, and knew best how to communicate new ideas to their pupils.

Charcoal production entrepreneurs provided valuable information to the initial ERC research into production methods and conversion efficiencies, revealing the large scale and sophistication of the production operations in the Blue Nile and Kassala provinces. The new mechanized farming project relied upon these distributors' knowledge of market, transport, and worker support infrastructure to develop and sustain new charcoal production activities. It is certain that, without the existence and involvement of these entrepreneurs, the large mechanized schemes would have hesitated to produce charcoal in locations hundreds of kilometers distant from major demand centres.

Farm and community nursery operators also served as contributors to innovation in building local information and promotion systems for forestry activities. They built upon local farm communications and product distribution networks to spread awareness of the potential benefits of the resources they were developing, and to deliver seedlings (whether free or through sales) to planting sites at the times and in the quantities they were requested. In so doing they avoided, in many cases, the coordination problems that had beset Forestry Department community planting programmes that did not rely on such indigenous distribution systems.

Institutional Lessons

The analysis of forest energy development in Sudan, in addition to showing the key role of users in the innovation process, shows the importance of flexibility in an R & D institution's role in support of this process. It demonstrates that an institution should not expect to present a fixed technical product to users, and should not see its task as one of persuading users to adopt such a fixed product. Rather, it should seek a more interactive relationship with technology users, in which scientists and users work together to adapt inventions (which could originate from both groups) to accommodate local needs and capabilities.

The charcoal production, charcoal stove, and forestry technologies that were applied in the field were often changed substantially from the forms originally envisaged by ERC programme planners. These changes occurred because the ERC encouraged technology users to react to its ideas and to adapt them to fit their particular concerns, not to adopt or reject them in the fixed form in which they had been presented. This flexibility was one of the greatest strengths of the programme itself, enabling it to make use of the substantial indigenous technical knowledge and resources existing in these forest energy areas.

The ERC's charcoal production work made the most radical adjustments in its technology development, virtually abandoning its original idea of introducing new brick and metal kiln designs to improve conversion efficiencies and minimize forest resource waste. Its studies determined that only marginal improvements were possible in practice, while the substantial costs and efforts necessary to introduce the new kilns seemed likely to discourage any widespread adoption of this type of technology. The studies also revealed that the waste situation was more complicated than had been assumed, with land clearing for agriculture providing perhaps an even greater source of forest resource loss than charcoal production, and with charcoal fines and other agricultural residues representing a potentially significant but unutilized energy resource in the same geographical area. The ERC responded by discontinuing its kiln improvement efforts and initiating new activities in briquetting and mechanized farm land resource management, channelling existing production and distribution capacity into the exploitation of these greater resource opportunities. Had it continued with the construction and promotion of brick and metal designs, it is unlikely that it would have achieved much success within the existing agricultural systems in the areas in which it was working.

In the area of improved charcoal stoves, the ERC not only encouraged traditional artisans to select their own stove materials and assembly methods, it also promoted an innovation strategy that could support a wide variety of local design initiatives. The ERC was able to promote different stove types in different areas of Sudan, through supporting traditional producers and distributors to adapt new design ideas to fit their local fabrication and market conditions. All-metal stoves using charcoal fines achieved good initial market success in central Sudan, where charcoal transported from long distances suffered from fractionation and low overall quality. In western Sudan, where charcoal resources were nearer to major demand centres, and such problems were not as important, ceramic-metal designs that reduced heat radiation during cooking were more successful. The latter design also enabled the strong local pottery sector to contribute to stove innovation, while the former employed the greater raw material resources and skills of the large and dynamic metal-working industry in central Sudan.

By emphasizing the importance of nurseries in its forestry efforts, the ERC stressed the flexibility of forestry technology in promoting innovation in fuelwood production. Locally constructed the controlled nurseries allowed agricultural managers, villages, and individual farmers to select which species they raised, and in so doing to select the types of afforestation activities they would initiate in their specific agricultural environments. This contrasted sharply with the CFA nurseries, which tended to be based around a few plantation-oriented species. A village in the arid western Sudan might choose to emphasize shelter, shade, and fodder trees, while an irrigated agricultural scheme might prefer fuelwood and pole species for future financial returns. This flexibility not only made the new nurseries more attractive within their communities, it also made them more successful in getting their seedlings well planted and protected.

In all its programmes, the ERC played the role not of a communicator of specific technologies, but of a developer of channels through which user knowledge and resources could be brought into the give-and-take of the technology development process. These user inputs were essential in order to adapt technologies to accommodate local needs and capabilities, to insure that the innovations they offered could be sustained.

Innovation as a Non-Linear Process

The overall picture of innovation that emerges from the analysis of the Sudan examples contrasts sharply with the notion of direct, continuous progressions depicted by the linear innovation model drawn in Chapter 2. Such a model places scientists and engineers in the position of the sole participants in technology design and development, with successful innovation being largely an issue of increasing production and adoption of good designs.

Innovation, in this caricature, is given its impetus solely by the work of the R & D sector, which propels it through production and into mass adoption, or consumption. The three sectors are largely segregated, and interact only as would workers on an assembly line, with production and consumption receiving and responding, while R & D, alone upstream in this process, shapes and develops the technology. The end product is a large number of virtually identical outputs, which producers and consumers adopt by adapting their practices in order to accommodate its requirements.

In the innovation cases examined in Sudan, both the overall course of the process and the divisions between the roles of the R & D, production, and consumption sectors were far less straightforward. There was no clear linear progression from invention to adoption. The technology itself, rather than being fixed after an initial R & D investigation, remained fluid throughout the innovation process, changing as users adapted it to reflect their particular skills, needs, and resource bases. In the case of the ERC's charcoal production work, findings from outside the R & D sector required a reexamination of the basic principles that stimulated the original inventive process - going back to the drawing board in abandoning notions of kiln design improvement, in order to pursue new, more productive directions for this technology area.

Innovation in forest energy development in Sudan illustrates the non-linear model presented in Figure 2.3 as a more accurate representation of technical change than this simple, segmented mechanism. It demonstrates that the impetus for technical change comes not only from R & D, but also from technology users in the production, distribution, and consumption sectors. Indeed, the implication of this representation of innovation is that, without user contributions from these areas, most technologies would not acquire sufficient force to break out from the shell of limited field trial and demonstration, and to progress into the realm of widespread production and utilization.

The non-linear view of the innovation process depicts technical change as dependent not on the continuous release of fixed technologies from the R & D system, but rather from the continuous interaction between R & D and technology user interests in designing and re-designing products and processes. In many cases the existing R & D system, in its institutional structure, is not capable of generating and sustaining this productive interaction. In such cases a cycle of demonstration, abandonment, and new demonstration of technologies often results, as the negative evaluations of renewable energy programmes presented in Chapter 3 confirmed.

On the other hand, institutional transformations that accommodate a more user-interactive innovation strategy can create a far more positive environment for technical change. Chapter 7 discussed how such transformations in the relationship of Forest Department officials to local agricultural and community interests played an essential part in the success of a diverse array of fuelwood/forestry projects. Where foresters established themselves in a new, service-oriented role, as opposed to their more police and authority-oriented traditional function, they gave local forestry technology users an opportunity to shape projects to better fit their needs and capabilities. These projects obtained good community participation and devotion to forestry success, while other projects, in which the foresters took charge of all decision-making, and in which forestry stood apart from other agricultural activities, fared less well.

Institutional Innovation Within the Energy Research Council

The ERC itself underwent an innovation in structure and policy through its development of projects under SREP. Such innovation was a necessary evolution to enable it to manage a more interactive technology development process. In order to move technologies “From the laboratory, to the factory, field, and home,” as per its motto, the ERC had to weaken the walls of its internal R & D structure somewhat, in order to open new linkages with technology users.[1]

The ERC's own institutional innovations, and their positive impact on forest energy technology development, provide empirical confirmation for Herrera's argument, which began the discussion of innovation in this dissertation, that a change in the methodology of R & D is an essential component for the successful generation of technologies for rural areas and the urban poor in developing nations. Although the ERC and its technical advisors were not aware of Herrera's work when they took the decisions that brought about changes in the institution's R & D strategy, their institutional reforms were very much in line with his recommendations for a new methodology.[2]

There were 3 principal elements involved in the ERC's own institutional innovations. First, there was a change of attitude about the roles of scientists and non-scientists in the innovation process. Largely as a result of its experience with the charcoal stoves contest, the ERC's researchers recognized local artisans as potential colleagues in the design process. The ERC engineers retained doubts as to whether traditional stovemakers could properly understand combustion principles and determine which designs were more energy efficient, but they acknowledged that these artisans could both produce a high quality finished product and discover ways to manufacture this basic product more quickly, cheaply, and accurately. Moreover, the engineers found, much to their surprise, that the artisans, working with poorer materials and tools than the engineers had available in their workshops, nevertheless could produce a more attractive model in far less time than could the workshop technician.

The ERC staff also recognized important non-scientist contributions to its other forest energy projects. Its researchers empirically demonstrated the skill of traditional charcoal producers, and enlisted the producers into the ERC's mechanized farm lane management programme. Its foresters witnessed successful nursery construction, tree propagation, and planting carried out by villagers with only minimal supervision. Um Inderaba village had its nursery completed and operational by the time the ERC foresters arrived to begin (they thought) the community project.

As a result of its experience with non-scientist contribution to technical change, the ERC began a second transformation: the incorporation of joint ventures involving its research staff, outside manufacturers, and agriculturalists into its new technology development efforts. These occurred in large projects, such as in the interaction between foresters, charcoal producers, and agricultural managers in the development of new land use practices involving afforestation and charcoal production on large mechanized farms, and in smaller efforts, such as the joint participation of ERC staff and accomplished artisans in training new producers in improved charcoal stove manufacture.

While before their work with SREP, ERC researchers had regarded the need for a new piece of equipment, such as a charcoal stove, as a signal to retire to the laboratory, they now took their early design ideas to the Khartoum Industrial Area, to seek interested craftsmen and workshops to join in prototype construction, further design, and testing. Instead of carrying out all new design tests within its own research facility, as it had been accustomed to doing, the ERC began to emphasize early field trials of new technologies in actual production and consumption situations. For example, if little was known about the silviculture of a particular tree species, or about the behaviour of certain trees and crops in intercropping situations, trials would be initiated not within ERC or CFA lands, but on individual farms and agricultural schemes awarded SREP grants, such as the Seleit scheme. This scheme was host to a number of R & D activities involving species propagation and agroforestry.

Thirdly, in forming and staffing a Dissemination Unit as an integral part of its own institutional structure, the ERC added a new dimension to its function that enabled it to better appreciate and utilize user needs and capabilities in technology development. In the past it had tended to focus largely on the technical issues pertaining to a given technology, dividing the work according to energy source among its solar, wind/hydro, and biomass departments. Its new Dissemination Unit was active in all technology areas, identifying constraints in resource supply and demand, indigenous knowledge and training needs, and promotion and information exchange requirements. The D.U., made up of engineers, economists, and other social scientists, worked with the scientists and engineers from the technology sections to attract and respond to user involvement with new techniques and devices, using field trials to both evaluate performance and assess production and distribution resources available for wider scale technology development efforts. Seminars and workshops helped further to attract and enhance user involvement in forest energy and other projects.

Wider Institutional Implications of the Sudanese Experience

> Participation...helps ready people for change by giving them a broader outlook and more skills. ... participative teams are not equivalent to “groupthink”, or inaction without consensus, or management by committee... They are action bodies that develop better systems, methods, products, or policies than would result from unilateral action by one responsible segment, or even from each of the team members working in isolation from the others. The results are likely to be more innovative and more easily used.[3]

The above passage is a fitting summary of the experiences cited in the previous chapters concerning forest energy development in Sudan. Yet, it was not written about Sudan, nor was it written about forestry, about energy, or even about a development issue. The passage comes from Rosabeth Moss Kanter’s book on how American industrial management should change in order to meet the challenge of remaining competitive in the technology-dominated markets of the future.

The aptness of Kanter’s words in the context of this dissertation illustrates its central tenet: that innovation, whether in high-technology industry or a poor rural village, thrives on the exploitation of knowledge of both technical possibility and existing demand. Encouraging the participation of technology users in the R & D process increases the likelihood that its products will profit from users knowledge and skill, and in so doing achieve widespread and successful application in the field. User-oriented and user-involved R & D possesses the awareness and the flexibility needed to cope with the variations, national, regional, and local, in conditions and demands in formulating robust designs and in re-innovating those designs as the innovation's environment itself evolves over time. The ERC's experience in Sudan demonstrates the importance of responding to such variations, whether through adjusting stove or forestry technologies to accommodate local needs, or through restructuring an entire technology development programme to acknowledge indigenous skills and resources, as in the case of charcoal production. Peters and Waterman, in seeking the sources of industrial success in America in their popular and influential work, <u>In Search of Excellence</u>, stressed the importance of this same awareness and responsiveness:

> innovative companies not only are unusually good at producing commercially viable new widgets; <u>innovative companies are especially adroit at continually responding to change of any sort in their environments</u> [emphasis theirs].[4]

Implications for Renewable Energy Organizations

The energy field, in general, has tended to work in a more isolated manner than other professions on technology development. Energy work as a whole, and forest energy work as a part of this whole, has been pervaded with an invention, supply-oriented bias which, crudely put, expresses the sentiment that, if fuel and machines to use it are provided, all development problems will be solved. This bias has led to the work attitude that, if enough time is spent in the laboratory designing and testing hardware, the needed machines and fuel will emerge, and that all that scientists and engineers require from outside the laboratory is basic information on resource availability and cost, so that they can calculate the cost per unit of energy output of their R & D products.

This bias has given scant attention to both user needs and the potential contribution of users to the innovation process. As is noted in Chapter 3, recent evaluations of renewable energy efforts have singled out this neglect as a prime cause of poor innovation performance. The Sudanese experience demonstrates that strategies that encourage users to participate in forest energy technology development lead to successful innovation. Work in forest energy, as well as work in renewable energy in general, needs to follow the movements in more mature development fields, such as agriculture, irrigation, and public health, and make its R & D system more user-interactive. It should not de-emphasize or curtail the contributions of scientists and engineers to technology development, but it should complement and enhance these efforts by incorporating the knowledge and skills of technology users into the design and dissemination process.

Forest energy development, in particular, depends strongly on responsiveness to environmental conditions. Its technologies must be sensitive to ecological capacities and constraints, which can vary substantially from location to location. Without the benefit of local knowledge of these conditions, it is difficult to see how such technologies can hope to be implemented over a wide area. Richards's comments on the implications of environmental variability for agricultural development efforts apply with equal weight to work in the forest energy sector:

> Many environmental problems are, in fact, localized and specific, and require local, ecologically particular responses. One of the answers...is through mobilizing and building upon existing local skills and initiatives. Everything should be done...to stimulate vigorous "indigenous science" and "indigenous technology".[5]

It now seems that, at least in the forestry area of forest energy development, the importance of the user role is beginning to be recognized. A recent FAO publication states at its outset,

> the scope and widespread dispersion of rural needs for local tree cover is now so great that it can only be tackled in an essentially self-help fashion by the people themselves...rural forestry innovations must be based on an understanding of traditional tree management practices and indigenous knowledge, of both men and women".[6]

While one might dispute that local needs and assistance capacities are any more diverse and less powerful, respectively, at present than they were at any point in the past, and question why the FAO chooses today, rather than 10 years ago, to make such a statement, it is encouraging to see this sort of sentiment expressed by a major actor in forest energy development assistance. The FAO document also cites user involvement as the key to successful innovation in forestry activities:

> Innovation should never be construed as replacements for existing indigenous means of building upon local strengths and capabilities. Effective design and introduction of forestry innovations ultimately require an understanding of where these activities fall within the spectrum of people's [sic] spontaneous responses to scarcity. This will only come with direct two-way communication between project planners and rural people, and a collaborative effort to devise methods by which the most appropriate innovations might be effectively introduced.[7]

One can only hope that this recognition will come to be shared not only by other donors in the forestry field, but also by all those engaged in other aspects of forest energy technology development, whether their focus is upon stove improvement, charcoal production, or the myriad of other fuels and devices based upon the utilization of forest resources.

Implications for Government R & D Management

The ERC, as it transformed itself to become more aware of and amenable to user contributions in technology development, achieved its first successes in moving technologies from the laboratory to the field, factory, and farm. Institutional structure and human resource management thus stand out as important factors in innovation in forest energy development. These management factors, cited by Kanter and others in Chapter 2 as important to the maintenance of competitive advantage in an industrial situation, have equal application within the context of technology and development. Building internal capacity to encourage and nurture new ideas, whether they come from inside or outside an organization, is a cornerstone of sound innovation management.

The ERC, in encouraging its staff to work directly with users on technology development matters, and through promoting user-interactive R & D through the work of its Dissemination Unit, transformed its basic institutional structure into a form more conducive to innovation. In so doing, the organization moved towards the formation of the “organic” linkages between government R & D and technology users espoused by Norman Clark. Rather than strengthening the barriers of hierarchy than can isolate R & D groups from the productive sectors of the economy, the ERC sought to dismantle such barriers and increase its ties to technology users. In so doing, it moved towards Clark’s “biological model” for institutional behaviour in the management of technical change.

Implications for Development Assistance

At the development assistance level, the challenge is how to channel the resources of developed nations into supporting the transformation of technology development work and the local institutions supporting that work into a more interactive user-oriented framework. The chapters concerned with forest energy development in Sudan contained little mention of the US Agency for International Development and its specific actions in relation to the implementation of any of the technology development programmes of the ERC. This omission does not reflect a failure on USAID’s part, but rather one of the most successful elements of its SREP project. While it provided critical financial resources to support the ERC’s activities, USAID left the fundamental decisions about technology directions and project implementation to the Sudanese institution. The long-term technical advisors from Georgia Tech helped to set up the REDG programme and other management systems within the ERC, but the ERC Technical Committee alone decided on all grant applications, and also approved all consultancy arrangements. ERC staff also maintained the responsibility for monitoring and evaluating all grant activities.

In this way, the development assistance offered the ERC concentrated less upon meeting specific technology production outputs than it did on developing indigenous expertise in managing technology development and innovation. SREP's importance lies less in the particular kilns, stoves, or trees that it supported, than in the manner in which it undertook their development. By centering the project about the REDG programme, which required the ERC to both establish links with external technology users, and to refine its own structure to accept and respond to user inputs, USAID encouraged the organization to interact with users in its technology development efforts. USAID provided an incentive for institutional innovations within the ERC itself, to make the organization more open to the contribution from local knowledge and skill resources.

Development assistance in forest energy in other nations can profit from this example. More emphasis should be placed on management skills, not in the sense of M.B.A. degrees, but rather in respect to abilities to communicate, evaluate, and make decisions, however these may be obtained. While specialized skills in various scientific disciplines, commonly obtained through the pursuit of diplomas and degrees, are important aids to the management of technical change, excessive specialization can be counterproductive, if it leads to a tendency to dismiss potential contributions to technical change that originate from outside research facilities.[8] Development assistance appears, in the energy area, to have over-specialized and under-communicated, producing institutions and projects dominated by often inappropriate and impractical technical concerns. This balance should be redressed by stressing the importance of interactive R & D, and using training to provide the skills necessary for developing country professionals to carry out such work.

Kanter, in assessing the task of restoring America's global competitiveness, remarks,

> the problem before us is not to invent more tools, but to use the ones we have.[9]

Using available resources should be considered the central task for development assistance. Unfortunately, too much assistance focuses on invention, neglecting this more important concern of innovation. This balance needs to be redressed. The utilization of existing resources, in the form of incorporating user participation into forest energy development programmes, provides both the problem and the solution for assistance in generating new technologies and applying them towards innovation in developing nations.

Their figures to remove Northern Region contributions. However, the demand figures, based on National Energy Administration household survey extrapolations, may be high (see discussion of the problems of these figures at the end of Chapter 6), so the potential contribution could be much greater than even Ali and Sid Ahmed suggest.

65. For information on the actual increases in crop performance obtained in Egyptian shelterbelt trials, see El Lakani, p. 47; and Ibrahim A. Heikal et. al., "The Influence of Shelterbelts on the Yield of Barley in Tahreer Province," (mimeo), Cairo: Agricultural Research Centre, 1982.

Chapter 8. INNOVATION AND FOREST ENERGY IN SUDAN

1. This motto originated as part of the NCR's programme, "Towards a Modern Scientific State", launched in 1982, and represents the motto of all 5 councils of the NCR.

2. Herrera's statement, "the specific type of technology a country or a region should adopt cannot be determined by a priori prescriptions; it should emerge from the very process of generating it," is very much in accord with the ERC's decision to work with local users to develop new forest energy technologies. Herrera, p. 27.

3. Kanter, pp. 34-35.

4. Peters and Waterman, p. 12.

5. Richards, Indigenous Agricultural Revolution, p. 12.

6. FAO, Tree Growing by Rural People, p. 2.

7. Ibid., p. 31.

8. The problem of academic "professionalism" in itself constituting a negative influence on technology development, through erecting barriers to R & D-user interaction, is discussed in a thought-provoking work by Robert Chambers, "Normal Professionalism, New Paradigms, and Development," paper presented for IDS Seminar on Poverty, Development, and Food, Falmer, 13-14 December 1985.

9. Kanter, p. 64.

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APPENDIX 1

GRANTS PROCEDURES

(documents reviewed and approved by ERC Technical Committee
15 December 1986)

Description of Grants Program
Under
Sudan Renewable Energy Project

Dec 9, 1983.

1. Introduction:

The Sudan Renewable Energy Program (SREP) supported by the USAID has organized a grants program to promote the use of renewable energy technologies. The grants are intended to help commercialize these technologies through dissemination activities. Grants are available to public and private institutions, entrepreneurs and community groups that can assist in their dissemination.

Funds will be available on semi-annual basis. The first submission cycle ends May 31, 1984. Thereafter the grant cycle will continue until all the funds under this program are used. It is expected that the program will continue for three years. (Please see section on grant procedures for more detailed description.)

2. Program Focus:

Proposals should focus on one of the five priority technologies under the SREP. These technologies are:

a. Fuelwood production through individual or community plots, agroforestry combinations, and fuelwood/management activities.
b. Charcoal production to demonstrate new and improved techniques to increase the available efficiency.
c. Promotion of new and improved charcoal stoves designs and improved manufacturing and marketing techniques.
d. Promotion of new and improved wood stoves for domestic and and commercial use.
e. Promotion of photovoltaic systems for small scale use in rural areas such as systems to recharge batteries in rural areas.

Grants will be given for activities which assist in promoting the use of the above 5 technologies on a broad scale.

3. Program Activities:

Grants will be used for such activities as:

a. Planting.
b. Pilot production and/or test marketing.
c. Extension activities by grantee which may include:
   - Production of promotional material.
   - Distribution and outreach.
   - Short courses or training.
   - Partial support for entrepreneurial activities.

4. Geographic Limitation:

The program is geographically limited to maximise the impact and to focus on those areas that are most adversely effected.

The approximate limits are:-

- On the North by the Northern boundary of Khartoum

Province.
- On the South by Damazine.
- On the East by El Gedaref and Kassala.
- On the West by El Obeid.

3. Grant Procedures:

a. Grant proposals can be submitted to the SREP office (University Barracks), the National Council for Research head, or the University Office of the Renewable Energy Research Institute. They should contain the following information:

1. Project objectives.
2. Geographic Area involved.
3. Nature of Market for Technology.
4. Projected Outputs from Project.
5. Leadership and Manpower involved.
6. Now the Project will become self-sustaining.

The proposal should also contain an address and/or telephone number through which SREP can contact the project leader for further information and discussion.

b. Proposals will be reviewed by the SREP staff and selected experts in the specific program field.

c. The review will be based on the following criteria:-

a. Technical and Economic Soundness of the proposal.
b. Extent of planned technology dissemination.
c. Social soundness and benefits of proposal.
d. Environmental impact.

d. If modifications to budget and/or work program are required, they will be negotiated and resolved before final approval is given.

6. Financial Procedures:

Consistent with the submitted proposal, the GRANTEE will submit to SREP Quarterly cash needs and status reports on special forms, which will be provided when grants are awarded.

Dec 9, 1983

Internal Review of Grant Proposals
Under
Sudan Renewable Energy Project

The procedure for evaluating grant proposals will include reviews by SREP/RERI staff and other related institutions, the Technical Committee of the Energy Research Council, and USAID. Each will review from a different perspective. These are:

1. SREP/RERI staff review in term of technical and economic feasibility, social soundness, environmental impact, work program, budget details, and consistency with overall Plan of Action for the specific priority area.

2. Technical Committee - review in terms of meeting program broad guidelines set down by the Technical Committee and Advisory Committees.

3. USAID - review based on consistency with the overall objectives of USAID grant and USAID general restrictions and guidelines for all USAID funding.

SREP/RERI Review:

Upon receipt of the proposal by the SREP Coordinator, the Coordinator and Chief of Party will conduct a preliminary review and assign, with the advice from the director of Renewable Energy Research Institute, a staff member to review the proposal. Written comments will be provided within 2 weeks of receipt of the proposal and will address the following issues:

1. Technical Feasibility
2. Economic Feasibility and social soundness
3. Contribution to the dissemination of the technologies.
   - demonstration
   - potential channel for extension
   - impact, population it may effect.
4. Environmental Impact

   In those cases where the technical capability is not available within the RERI, expert reviews will be solicited from related institutions. In all cases, an honorarium will be given to reviews upon receipt of their written comments.

   The reviewer shall receive an honorarium of LS 100 for his efforts.

Technical Committee Review:

After review by RERI/SREP staff, the Coordinator and Chief of Party will select and present those proposals that receive favourable review to the Technical Committee. The Technical Committee will meet at least once a month to review these proposals. Proposals for consideration will be given to Technical Committee Representatives at least three days prior to the meeting in which they will be discussed. The Technical Committee will evaluate the proposal for its conformity to the broad program guidelines set down for the technology involved. It will return the proposal to the Coordinator and the Chief of Party with its approval or rejection no later than 2 weeks after the first meeting at which it is presented. Proposals not returned within this time will be considered to have received approval. Proposals approved by the Technical Committee will be sent on to the USAID representative for concurrence.

In some cases proposals which are approved by the Technical Committee as basically sound may need modification for technical or budgetary reasons. In those cases, the Technical Committee will instruct the Coordinator and the Chief of Party to negotiate these changes with the proposer.

USAID Review:

Copies of the proposals sent to the Technical Committee for consideration will also be sent to the USAID Energy Officer. Where feasible, the Energy Officer or his representatives will attend the Technical Committee Meetings to discuss the grant proposals. If the USAID representative cannot attend, the approved proposals will be passed on to USAID for review and concurrence.

Timetable

The review should be the following

		30 days	60 days
		....	
1.	Receipt of Proposal	x	
2.	Assignment of SREP/RERI staff review	x...........x	
3.	Presentation to Technical Committee and USAID	x............x	
4.	*Further negotiation		x.............x
5.	Award Grant		x

* Extensive Negotiations to improve grant proposal may require additional time beyond the 60 days allotted for proposal review.

APPENDIX 2

CHARCOAL STOVE MONITORING REPORT

(sample ERC report prepared by Mary Clarkin and
Shadia Nasr El Din, Dissemination Unit)

CANUN EL DUGA STATUS REPORT
SEPTEMBER 1985

I. Total number of producers: 43*

II. Location of producers: 23 Khartoum, 5 Omdurman, 3 Khartoum North, 6 El Obeid, 3 Gedaref, 4 Abu Galfar/Wad Medani

III. Total production: 696
- open-draft: 446
- control-draft: 250

IV. Number of stoves produced by area:

341 Khartoum	14 Omdurman	8 Khartoum North
68 Gedaref	156 El Obeid	88 Abu Galfar/Wad Medani**

V. Nature of sales:

Khartoum Province: 336 open-draft
20 control-draft

Selling price: Ls 13 NEA, FAO
Ls 15 Souk demonstration
Ls 8-10 to retailers
Ls 10-12 to customers

Location: NEA, FAO, Souk demonstration, Kosti, Wad Medani, Souk El Sajanna, Souk Ashabi, Souk Omdurman.

Abu Galfa/Wad Medani: 88 open-draft
0 control-draft

Selling price: Ls 16.25 directly to customers
Location: Wad Medani area.

Gedaref: 0 open-draft
68 control-draft

Selling price Ls 15
Location: IRC (International Relief Commission), Gedaref Souk, Deim El Nur.

El Obeid: 9 open-draft
147 control-draft

Selling price:unavailable
Location: Souk Abu Gahal, Supplemental feeding centres.

Charcoal***

Zereba:****

Price of ordinary charcoal sack: Ls 16
Price of siwa (fines) sack: Ls 2.5
Price of safiha: Ls 3.5
Price of ruba (4 malwa unit): Ls 3.0
Price of ½ ruba: Ls 1.5
Price of malwa: 75 pt.

Dakhan:*****

Price of ordinary charcoal sack: Ls 20******
Price of large-size milk can: Ls 2.5

Notes

* Production figures from Shendi, Kosti and Sennar were not reported this month.

** A severe shortage of metal in Wad Medani was cited as the cause of the drop in producers and output. Also, producers in Abu Galfa/Wad Medani and Gedaref are making agricultural tools, since demand exceeds supply.

*** The shortage of charcoal may be artificial as it developed following the announcement the government would enforce the legal (lower) prices.

**** Omdurman and Kobber zerebas were visited.

***** A dukhan at Khartoum 3 was visited. A number of other dukhans said the charcoal at their places were for their use only (ful).