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PRACTICAL TECHNOLOGY TRANSFER IN SMALL
SCALE FISHERIES

by

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A State-of-the-Art Paper prepared for the United States
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SUMMARY

Following a consideration of the history of technology transfer within small scale fisheries, particularly during the past quarter century, the paper considers the various reasons for failure in the past and develops a summary of features important in successful technology transfer.

Based on these features, required components for a practical technology transfer project are developed:

- inventory and analysis of the socio-cultural, economic and technical environment within which the transfer and change is to take place, together with an assessment of the feasibility of technology for transfer and procedures for effecting and maintaining the transfer.
- organizational arrangements for a suitable Delivery System for effecting, supporting, monitoring, sustaining and multiplying effects of the transfer.
- the actual effecting, monitoring and managing of the transfer to a self sustaining level.

The whole task is considered to require an interdisciplinary team of social and resource scientists, technologists and training specialists.

A complete section is devoted to "appropriate technology" for transfer within the small scale fisheries sector, and a list of criteria an "ideal" piece of appropriate technology should satisfy is developed. Although much of the required technology is already available, there exists an obvious gap in communication regarding knowledge of its availability in the field. Some obvious gaps in technology exist and are identified, as is the desirability of promoting programs directed towards development of appropriate technology for small scale fisheries. Specific needs are identified as:

- development of a greater number of technical papers, reports, instructional books, training manuals, data sheets, fact sheets, posters and visual aids, together with more efficient distribution arrangements.

- development of a simple, effective, hauler for fishing gear which uses the simplest possible drive system and which may be assembled from items and expertise available in the developing countries.
- a continuing research and development program aimed at small craft, equipment and fishing gear appropriate for various conditions in developing nations. Consideration of the establishment of one or more regional centers concentrating on development and dissemination of such small scale fisheries appropriate technology.

After establishing the needs of an effective Delivery System, it is anticipated that Fisheries Extension Services will tend to replace the traditional expert/counterpart arrangement. Expatriate experts will continue to be required but their role will change to that of catalysts involved more behind-the-scenes.

Various aspects of organization, methodology and personnel needs of an extension service are considered. Specific needs are identified as:

- research on appropriate organizational structures and methodology for fisheries extension services.
- development and testing of training programs for all levels of extension personnel.
- immediate establishment of at least one regional center to develop and test model extension personnel training programs for later transfer to additional centers and individual developing countries.

1. Historical Aspects

Technology transfer in fisheries has been occurring for centuries as fishermen adopted technological advances to their own purpose. For the most part, the result was of an evolutionary nature with an occasional forward bound as when power replaced sail as a result of the industrial revolution, or synthetic fibers replaced natural materials for fishing gear.

Rather naturally, transfer of technology was more rapid in the industrially advanced nations, as fishermen lived amongst the advances, and were able to participate in the continuing economic and social developments. The advance was somewhat slow in travelling to many countries, principally those now considered as "developing" nations, and it was not until the early 1950's that significant efforts began, to accelerate the development of small scale fisheries in these nations.

At that time, the swing to independent nation status for colonial territories was gaining momentum and many of these countries, particularly in the tropical areas, were reliant on rather primitive small scale fisheries for much of their protein food supply. Indeed, in 1974, 70% of the catch in Ghana came from this sector, in Indonesia about 98% (Ref.1).

Parallelling the swing to independence was the development of the U.N. Food and Agriculture Organization's interest in fisheries, which led to the creation of the Department of Fisheries in 1965, with a mandate to promote and work for the development of World fisheries resources in member countries. At the same time, the former colonial powers were also providing assistance to the newly emergent nations, often aimed towards the development of small scale or lake fisheries.

Non-colonial countries have also been involved from the beginning through National Development agencies, Scandinavian countries being particularly prominent, to be joined by others such as Japan and Canada.

In virtually every case, small scale fisheries development programs arising as a result of Multi-lateral and bi-lateral assistance programs have involved various aspects of technology transfer. Most often, this has involved the transfer of particular pieces of technology used in a more developed nation, such as the introduction of outboard motors to Ghana and India. In most cases, training, often of an informal nature, was associated with such transfer; in some cases more formal training courses were involved.

Technical accounts of such early activities were given at the series of conferences organized by FAO in the 1950's and 1960's on fishing vessels and fishing gear, which brought together people from both developed and developing nations. While much of the proceedings of the conferences (published as the "Fishing Boats of the World" and "Fishing Gear of the World" series - refs. 2,3,4,5,6,7) were concerned with the more industrialized fisheries, each contained sections devoted to small scale fisheries. The various papers in these references therefore provide a guide to such developments during the early 1950's to the late 1960's, at which time the series of conferences came to a halt.

These reports indicate that in the early years activities were concentrated directly upon technical considerations, using "expert" boat builders, naval architects, gear technologists and master fishermen from more developed nations to introduce the specific aspects of technology. It is apparent that at this stage it was anticipated that if the transfer proved technically feasible when introduced by experts, it would automatically be adopted and continued by the local fishermen. In some cases this proved to be valid, as with the introduction of the outboard motors to Ghana, or the development of traditional gillnets into purse seines

in Senegal and other West African countries (see Ref.8). In other cases the results were not accepted, as with surf boats in West Africa or the installation of inboard power for indigenous canoes.

Socio-cultural and economic considerations appear to have been recognized in the mid-1960's (Ref.4) but actual programs continued to be based principally upon technical considerations for a number of years. Economists had been involved in fisheries development programs for many years, but it is apparent that very little attention was paid to coordinating their activities into actual technology transfer. Researchers have been investigating socio-cultural aspects of development and change for a number of years (Ref.6), but have had little direct input into the technology transfer being undertaken in small scale fisheries development programs.

As a result of the FAO Committee on Fisheries (COFI) meeting in 1974 (Ref.15), small scale fisheries has now assumed a prominent role in development activities. Not only are the policies of the UNDP, World Bank, Regional Banks, etc., reflecting such interest, but also a number of industrially developed countries having a record of fisheries assistance programs are guiding assistance to the sector (Ref.1).

As a result of this commitment to small scale fisheries, a reorganization (Ref.10) has enabled the FAO Department of Fisheries to provide leadership in the field. An FAO Expert Consultation on Small Scale Fisheries Development held in Rome during 1974 brought together workers experienced in the field (Ref. 17) and it was at this consultation that the need for socio-cultural aspects was brought into direct focus for the first time; one of the main guidelines which came from the consultation being:

"An essential requirement from the start is to find out and take into account the hopes, needs and aspirations of the fishermen and thier communities and to ensure that they understand and agree with the objectives of the project and become fully involved in it".

On the technical front, publications have been produced on boats and fishing gear applicable for small scale fisheries (refs. 11, 12, 13) with more being developed. Training is receiving considerably increased attention with more personnel devoted to the problems of the small scale fishermen. The whole question of training and personnel development is under examination and development.

It is apparent that technology transfer is a vital ingredient in the development process for small scale fisheries and that the need for a well-rounded and complete approach involving technical, social, economic, and organizational aspects is understood.

The field is dynamic and ripening rapidly. The need is to control that ripening to produce the desired end-result: an improvement in the life of the recipients (Ref.14).

2. Components of Successful Technology Transfer

In order to be considered a successful transfer, it seems to be generally agreed that a particular item of technology must be accepted, used and retained in use by the target group on a continuing basis following termination of the active project and without a continuous infusion of assistance from overseas. If the technology transfer does not achieve this end, then it must be regarded as a failure since it has obviously not effected an improvement in the life of it's recipients.

Other than from purely technical considerations, very little definitive information is available as to why particular small scale fisheries projects involving technology transfer were successes or failures. Discussions with experienced people from FAO and other Agencies indicate that no work has been undertaken directed to that end.

In the absence of such documentation, it is necessary to rely upon other avenues such as discussions with people experienced in international small scale fisheries development (Ref.17 may be considered particularly useful in this regard), single sentences or paragraphs included in progress and final reports for completed projects, proposals for continuation or new projects, remarks of experienced workers involved in conference proceedings and papers, and personal observation.

A comprehensive study of problems in international small scale agriculture projects (Ref.16) has been undertaken and some similarity to problems in small scale fisheries is apparent. Considerable care is appropriate however in transferring findings from agriculture to the fisheries sector, due to the difference in nature of the two operations: hunting versus husbanding, and the particular social, cultural and psychological environment of the small scale fishermen (Ref.9).

While all such evidence must be considered circumstantial, it does, with the aid of personal experience, provide some guidance towards important factors involved.

A first look at some of the reasons for failure illustrate the problems involved and which must be overcome:

- project terminated or destroyed as a result of internal disturbance, war, or political unrest.
- technology too complex.
- inadequate financing.
- inadequate duration of project.
- lack of support facilities (spare parts, trained personnel etc.).
- insufficient commitment from host government in terms of manpower, facilities, moral support, economic climate.
- technology incompatible with the socio-cultural climate.
- operations utilizing the technology proved uneconomic.
- use of the technology incompatible with the economic status of the recipients.
- inadequate or unreliable delivery system.
- inadequate communication between the parties involved at specific or all levels.

Except for the first item on the above list, all the factors are, to at least some extent, under the control of those actively engaged in the technology transfer at various levels of organization, management or field activity.

Virtually all development/assistance projects involve the transfer of technology to a greater or lesser extent. It is essential therefore that throughout the planning and execution stages, ways are found to avoid the problems noted above.

Both references 9 and 17 offer guidance regarding important features leading to successful programs of technology transfer. Although they approached the question from differing aspects (reference 9 from the social scientist's viewpoint, and reference 17 from the angle of experienced personnel in international fisheries development) and express their conclusions in different language, they show a remarkable concensus regarding their conclusions and recommendations which may be summarized as follows:

- the overall project should be conceived and developed in an effective manner in order that the transfer may be given the best possible chance of success. This requires a full knowledge of local government, agency or institution intent regarding policy, funds, inputs, services, facilities, staff etc. and the government's full support and interest in the project. This in itself may involve technology transfer at various levels within the host country's governmental structure.
- the technology for transfer, and the process of transfer must harmonize with the social and economic environment and traditional patterns and customs, while introducing improvements and gradual, acceptable, changes.
- an essential requirement is that the transfer is in line with the hopes, needs and aspirations of the fishermen and their communities. It must be ensured that the groups understand and agree with the objectives and become fully involved in the activities.
- the transfers and changes should be target group oriented rather than change agency oriented.
- the communication process between those promoting the change (change agents) and those receiving the change must be carefully developed. The change agents themselves must be able to demonstrate empathy, similarity and credibility in the eyes of the target group.
- the complexity of the piece(s) of technology to be transferred must be compatible with the technological and educational competence of the target group.

- a step-by-step approach rather than a revolutionary change should be adopted.
- fullest use should be made of local skills, crafts, industries and materials with which the target group has familiarity and confidence.
- the duration of the project should be sufficient to permit the introduction, trial and evaluation of the transfer. Long term or open-ended arrangements are appropriate.
- the organizational structure and support must be such that commitments to the fishermen are met on time, adequate continuing services are provided, and multiplying effects are promoted.

From the practical viewpoint of actually planning and executing a technology transfer project, it would appear that these requirements would involve the following components which are offered as a preliminary proposal for testing and development:

1. Inventory and analysis of the socio-cultural, economic and technical environment within which the transfer and change is to take place, together with an assessment of the feasibility of technology for transfer.

An interdisciplinary team consisting of a sociologist, economist, resource scientist and appropriate technologists (fishing/vessel/equipment/food) would be involved. The end result should be a complete description of the environment, a programmed selection of technology appropriate for transfer in a step-by-step fashion, and procedures for effecting, supporting and maintaining the transfer. Such procedures should include target group preparation, training and support, and provide build-in flexibility.

Ref. 9 notes that social scientists are often expected to conduct research in an unrealistically short time period. Present understanding is that at least one year should be allowed for this component unless adequate data and analysis is in existence.

2. Organizational arrangements for suitable delivery system for effecting, supporting, monitoring, sustaining and multiplying effects of the transfer, and for continuation of step-by-step development.

Such a delivery system must provide an appropriate organizational arrangement, trained and motivated personnel and adequate preparation for technical and communications aspects of the transfer. Such a system cannot be developed overnight and from even training considerations alone, at least eighteen months should be allowed, and more if the concepts involved are new to the host country.

This component would involve appropriate technical and training personnel in addition to social and resource scientists. It may well commence in parallel in the first component above. The end result should be a delivery system prepared to effect, support, monitor, sustain, multiply and continue technology transfer in the long term.

3. Effecting, monitoring and managing the transfer to a self sustaining level.

This component is the heart of the project and should be carried out in line with the procedures developed in the first component. It is essential that a continuous monitoring be undertaken during this stage and that sufficient flexibility actually exists to adjust the operations as a result of the monitoring.

Personnel involved would include sociologist, economist, resource scientist, appropriate technologists and training specialists.

The time period should be open-ended within the limits of project duration, with progressively greater responsibility for management being undertaken by the national personnel of the delivery system.

The components outlined above all include interdisciplinary approaches with specialist working as a team member towards a common goal. Both expatriate and national personnel should work side by side throughout.

The sociological and economic aspects of the components are outside the scope of this document and are the subjects of other papers (refs. 9 and 18). Technical aspects of Food Technology in terms of pieces of technology for transfer are also outside the scope of this document and are the subject of Ref. 19.

Of direct interest here are the technology which it is appropriate to transfer for small scale fishing operations, and the delivery system to be used to promote and manage technology transfer activities. These are the subjects of the following sections.

3. Selection of Technology for Transfer

It is evident from foregoing discussion that the selection of the particular pieces of technology for transfer to small scale fishermen is heavily influenced by social and economic factors in addition to the purely technical considerations of its ability to perform the job effectively and being within the capabilities of the users to operate and maintain effectively.

Experience indicates that many items of technology such as vessels and equipment considered commonplace in the fisheries of industrially developed nations proved unsuitable for use in developing countries, due to their representing too revolutionary a change in either the social, economic or technological environment.

The introduction of a particular piece of technology which requires at the same time a heavy capital investment, a reduction in manpower for operation (due to mechanisation), and a level of operational and maintenance sophistication not previously faced by a community of low educational opportunity is likely to be in trouble from social, economic and technical viewpoints; the fisherman is unable to meet his payments on a loan, some of his crew members are unable to provide for families as they are out of a job, and the fisherman and his remaining crew are unable to use what is to them sophisticated equipment to its potential, or to maintain it in operation under what are often very rigorous conditions. A visitor to small scale fisheries areas in many developing countries will see lines of vessels drawn up out of the water and deteriorating as a result of one or more of the foregoing problems.

The whole situation is exacerbated if the vessel and equipment is imported in total from overseas, due to the difficulties which usually exist regarding the need to import spare parts (often the government has foreign exchange problems), service facilities (the manufacturers have no representative in the area) and the unavailability of

technical assistance regarding operation and maintenance. In many circumstances the fisherman may not even be able to read or begin to understand any manuals made available by the manufacturers. An example may serve to illustrate the problems: Reference 20 reports that:

"In 1965, the Ceylon Fisheries Corporation attempted to operate in the offshore range with a fleet of 40 locally built steel boats of 11 tons each. The venture failed because these boats were not suited to operation in these waters. The steel hull of the boat presented problems of maintenance, the insulation of the fish holds was unsatisfactory; the boats were not equipped with radio telephones; accommodation for the crew was poor.

There was also problems of management; fishing gear was inadequate, and training facilities for crew onshore were poor. The result is that of the 40 boats only a few are now operating" (1975).

This ~~was~~ in an area having what may be considered a reasonably advanced capability regarding technology (the steel boats were built locally). A visit to the fishing areas of many developing countries will show similar situations under a wide range of social, economic and technical environments.

It is apparent therefore that the technology to be transferred must be "appropriate" for the task and conditions.

"Appropriate Technology" is becoming a term used to describe an alternative to "modern" or "industrialized" technologies. Ref.21 states:

"Appropriate Technology is a technology that is compatible with the needs and human, material, economic and environmental resources of a community or society."

Some characteristics of the technology are listed as:

"being small scale, simple, low cost and labour intensive"

"The capacity to utilize locally available skills and resources is quite fundamental to the process."

These principles appear to meet the needs of the small scale fisheries sector as based on the previous discussions. The principles of appropriate technology concepts have been applied to various aspects of rural development in the international scene (refs. 21, 22, 23), but very little attention has been given to the fisheries. It should be noted that the term may be used interchangeably with others, e.g. "intermediate", "gentle" or "low cost" technology. Another term found to be in use is "step level technology".

Encouragement for the use of such technology is given by the conclusions of the FAO Expert Consultation on Small Scale Fisheries Development (1975), that:

"step-by-step improvement of existing vessels in design and use of new materials etc. is the best approach"

and:

"the development process must be conceived in terms of a step-by-step approach, not a revolutionary change. The effort must be to harmonize what is being done with traditional patterns and customs while introducing improvements and gradual acceptable changes. The fullest use, too, should be made of local skills and industry and local materials"

Rather naturally, what represents a revolutionary change in some circumstances might be a step approach in others, so that it appears of major importance that any technology for transfer be selected on the basis of it's being "appropriate" for the particular conditions - hence the importance of the socio-economic-technical inventory and analysis outlined in the previous section.

Based on the foregoing, it is useful to attempt a first listing of criteria a piece of "ideal" appropriate technology should satisfy:

- not displace manpower but use existing labor intensiveness to increase production, improve quality or otherwise increase earning.
- clearly desirable economically.
- utilize locally available expertise and materials.
- if replacing existing items (such as a boat) should have comparable cost but greater potential for economic and social profitability.
- be within the capabilities of fishermen to operate and maintain within realistic training possibilities.
- possess extreme reliability under arduous operating conditions.

It must be considered unrealistic to expect these to be achieved in all cases. Ref. 17 remarks:

"the real test of suitability of a boat for a fishery was its profitability"

This statement must surely be extendable to other items such as gear and equipment and the term profitability to include both social and economic aspects.

It is often stated that in order for fishermen to adopt a particular piece of equipment, it must be "simple, cheap and strong"; such criteria appear ideally suited to appropriate technology for the small scale fisheries sector.

An observer making a tour of small scale fisheries in developing countries will note a very wide range of technical development both from one country to another, and within the same country.

In some cases, powered vessels are already in use, so that appropriate technology for transfer may, in general, be expected to be concerned with improving the economic and social effectiveness of these craft, perhaps by the addition of some simple equipment to enable the crew to handle more or larger fishing gear, or to the gear in order to increase it's catching power.

In other cases the fishery may be ready for the step of moving to boats allowing greater range and carrying capacity than the existing craft.

As a third example, it may be viable, as a first step, to increase the catching power of indigenous craft through the introduction of simple changes to fishing gear, operational techniques, or the boat itself.

Despite the desirability of using local materials and skills whenever possible, in practice many items will continue to be purchased from outside the country due to the requirements of donor agencies, availability, and lack of internal manufacturing capabilities. It is highly desirable, if not essential, that standardization be sought regarding items purchased overseas; this will lead to more efficient and easier supply of spares and therefore more efficient maintenance, and a greater possibility of attracting a service facility.

As noted in Reference 24, much of the technology needed for transfer in small scale fisheries already exists. One particular problem is though the existence of particular pieces of technology which may be ideal for transfer in a particular circumstance may not be known to the people involved. This knowledge does not mean the person or persons involved does not know the job; it does mean however that there is a communication gap that needs filling.

FAO has been helping to bridge that gap through publications such as those on small boats and gear (Refs. 11, 12, 13). Reference 17 notes that there is a need for an increase in the number of technical papers, reports, instructional books, training manuals etc. and special efforts to have them more widely distributed, particularly among field staff in developing countries.

At the same meeting, experts also recommended that an attempt should be made to persuade universities, technical institutions and research centers to concentrate more on the problems of small scale fisheries with the research focussed more sharply on practical problems.

The task is of such magnitude that even FAO with its resources and emphasis on small scale fisheries cannot be expected to answer this need alone. These challenges must be met however if the technological needs of the small scale fishermen are to be satisfied. In cooperation with FAO, the need for specific technical manuals/data sheets/fact sheets should be established, and responsibilities assumed by interested institutions possessing the appropriate capabilities for their preparation and distribution to as wide an audience as possible. Full participation by all such contributors to a proposed series of technical workshops (Ref. 17) will assist in conducting and disseminating knowledge of what technology exists and its possible applications.

At the same time, there appears to be obvious technological gaps; Ref. 17 refers to boats and fishing gear but omits mention of gear handling equipment. Such equipment has a vital role to play in the increase of productivity by a boat of certain size and crew through the use of more and larger fishing gear.

A particular need mentioned time and time again by experienced workers is for a simple effective hauler suitable for lines, nets or for general rope handling. Many haulers exist within the small scale fisheries of developed nations, but they are of relatively high technology compared with the needs of the developing countries; moreover, they must be imported in total and in most cases require a sophisticated power system to accompany them.

The need is to develop a device using the simplest possible drive system, which may be assembled from items and expertise available in the developing countries.

Although a tremendous range of small boats have been introduced under various situations, this has been done on a case by case basis. A vast background of knowledge exists, principally in FAO, regarding boats suitable for various conditions (as demonstrated by Refs. 11 & 12 and various

papers in Refs. 3 & 4, but so far as can be ascertained no continuing applied research and development program has been undertaken concerning small craft for use in developing fisheries. The institution of such a program even on a relatively small scale within a suitable institution appears basic to development needs aimed at small scale fishermen.

In general, the same comments apply to fishing gear for small scale fisheries; no generalized research and development program is underway although a number of institutions in various countries may be concerned (at a low level of work) with their own in-country problems.

In light of these needs, it may not be untimely to consider the idea of establishing at least one, or perhaps several, regional centers concentrating on development and dissemination of small scale fishery technology and equipment at the appropriate technology level and on a continuing basis.

4. The Delivery System

References 9, 17 and 25 provide guidance concerning the needs of an effective delivery system, which may be summarized as follows:

- involvement of fishermen and fishing communities.
- effective organizational structure and support to ensure that commitments are met in a timely fashion.
- fullest possible use of local skills and materials.
- target population oriented.
- personnel exhibit empathy with target group, with contact personnel demonstrating overall similarity and credibility in the eyes of the target group.
- personnel are adequately trained and highly motivated.
- able to provide adequate pre-transfer training for the target group.
- able to provide post transfer service.
- possesses adequate personnel, equipment and supplies.
- full commitment of government regarding funding and inputs on an open ended, or at least a long term basis.

Traditionally, the delivery system for transfer of technology has consisted of expatriate "experts" brought into a country. Presumably the expert, usually from one of the developed nations in Europe, North America or Japan, was meant to possess almost mystic powers and a total knowledge of small scale fisheries. Unfortunately human beings often fail to live up to such expectation.

Each expert has commonly been matched with a counterpart, a native of the country concerned, whose task is to work with the expert while undergoing what is essentially "on the job" training. The counterpart might or might not have received formal training in fisheries and, very likely, would be a government officer.

Such a delivery system was introduced in the early 1950's, and at that time appears to have been the most appropriate way to provide the expertise needed while at the same time training national personnel. At that time, most of the developing countries can have possessed very few personnel capable in the field of small scale fisheries development. Even today, only a few of those countries have effectively trained personnel who are sufficiently skilled and willing to work with fishermen on a day to day basis.

Although most developing countries now possess a Fisheries Department or Service, it is usual for the personnel to have been trained through a "traditional" fisheries education overseas which concentrates on fisheries science. It is becoming more frequent for these fisheries officers to be prepared in either economics or food technology, but only rarely is one found who has received training or education preparing him to work in the commercial fisheries. No doubt this is largely due to the fact that the officers are required to hold a bachelor's degree as a condition for government appointment, and these have only recently become available in "commercial fisheries".

In practice, this means that the fisheries officers do not possess the skills and knowledge needed to work with the commercial fishermen, especially the small scale sector. Also, the officer may feel his inadequacies or consider it undignified and beneath his position to work with his hands and alongside fishermen.

As a result, even officers who are assigned the tasks of promoting development will often be found in their offices behind a desk rather than in the field (anyway, it is much more comfortable in an air conditioned office).

An "expert" entering a country is therefore faced with a very difficult task; not only must he, a stranger, undertake the task of technology transfer but he must also train a counterpart who quite possibly does not possess

an adequate background, and moreover who is likely to be from a different area of the country and/or social level from the target group.

Some of the problems faced by expatriate experts are discussed in Reference 26. In view of all the difficulties they face, it must be considered a great credit to the experts concerned that success has been achieved in many development projects involving technology transfer.

In the light of the needs for an effective delivery system as established at the beginning on this section, the expert/counterpart system does not appear ideally suited for working with small scale fisheries. However, there can be no doubt that the continuing use of experts and/or consultants will be obligatory in technology transfer for the foreseeable future.

It may be anticipated that the role of the expert will be changing in the future from being directly concerned in the day to day activities with fishermen, to being a catalyst working more behind the scenes in assisting personnel from the host country in organizing and undertaking the technology transfer.

The organizational structure now receiving close attention as a delivery system for technology transfer is the Fisheries Extension Service. One of the main guidelines emerging from the Expert Consultation on Small Scale Fisheries Development, held in Rome during 1975 (ref.17) was:

"The Extension Service is of critical importance and has a big role to play in development, there must be agreement to increase the number of workers and raise their standard of training to match requirements."

FAO has acted upon this guideline and is now energetically working on the development of organizational structures, methods and personnel.

Fisheries extension services are nominally in existence in many developing countries, and more are being instituted as a result of the above guideline. Apart from a few exceptions, however, they have proved relatively ineffective in efficiently undertaking extension activities.

One of the principal problems is that the meaning of "extension" is not fully understood; the personnel are not effectively trained and are also charged with other duties such as law enforcement, collection of debts or fees.

As noted in Ref.27:

"A successful and effective extension worker must have the confidence of the fishermen and their families and be regarded by them as a friend. If he is charged with additional duties such as law enforcement, collecting of dues or debts, chasing breakers of fisheries regulations, or even merely subjecting fishermen to the odious task of filling in questionnaires and forms or taking statistics - all hateful chores to most fishermen - he cannot establish himself as the fishermen's confidant and friend".

Both references 25 and 27 provide guidance concerning the organization and operation of fisheries extension services. It appears evident that such an arrangement has promise towards satisfying the needs of an effective delivery system as outlined earlier.

Because of the political and government structure in most developing nations, it is evident that fisheries extension in nearly every case is likely to be a direct government function. So are most of the agricultural extension services in the developing world. However, because of the differing social, cultural and psychological environment of small scale fishermen compared with small farmers (Ref.9), it may be anticipated that variations will develop in organization, methods and techniques.

Countries differ widely in the numbers of small scale fishermen, the length and nature of coastline and the grouping of fisheries communities. It may be expected therefore that the organizational structure of an effective extension service will differ from one country to another, and between regions within a country. There is, therefore, a very real need for continuing attention to be given to the development of organizational structures which are appropriate for these differing conditions.

Extension methods may also be expected to differ, depending upon the particular circumstances in a country or area. Effective extension make use of all possible means of communication including mass media, large and small meetings, discussion groups, posters and informal contacts. The extent to which each means is useful in a particular place is dependent on such factors as literacy, availability of radio and television, newspapers etc; however the one common method is that of face to face contacts and demonstrations; Reference 25 notes:

"Some years ago a research study of how people learn was undertaken in the United States. The conclusions were that people remember 10% of what they hear, 50% of what they see, 90% of what is seen, heard and demonstrated".

Although perhaps not appropriate to all cases, these findings also indicate that a tremendous amount of attention needs to be given to extension methodology and techniques as they apply to the small scale fisheries situation. The question of communication with target groups is considered in Reference 28.

No matter how good the organizational structure and how well researched and articulated the methodology and techniques, the whole of the delivery system is basically dependent on the personnel involved. If they are inadequate or less than wholly motivated and competent, then the

likelihood of success must be considered remote. It is here, then, that particular efforts must be made to recruit and prepare effective extension agents and administrators at all levels.

It is evident that the use of fisheries officers trained in the traditional manner will not meet the need. Besides knowing something of every aspect of small scale fisheries, the extension worker should be the master of at least one expertise important to the fisherman, at the practical as well as the technical level. The benefits of selecting workers from among the communities they will be serving is evident from the list of needs established earlier.

Given the likelihood that government officers will continue to possess a degree as a condition of employment, it is probable that few state workers could reach this level within the time scale under which extension services need to be developed. An alternative is to provide such recruits with a shorter duration training and utilize them as paraprofessionals, a technique which has been used with success in the USA.

No matter at what level personnel are recruited, certainly the most important aspect of their preparation is training in the practical and theoretical aspects of fisheries together with the methodology and techniques of extension work.

Not only must these workers be trained, but also the group leaders and people for positions of greater responsibility. With each step of a career ladder in extension, additional training and preparation will be needed.

Whether the community workers should be trained locally or at regional centers, there is a need for appropriate programs to be developed. Regional centers appear to offer advantages for the training of supervisory personnel; such a center might be within a country (if numbers make it feasible) or in many cases a center could serve a whole region.

The need is so apparent and critical that it appears essential that the earliest possible attention needs to be given, on an urgent basis, to the whole question of training extension personnel together with the testing and development of programs. The establishment of at least one regional center to develop, test and demonstrate appropriate training programs should be given highest priority.

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