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CONSTRAINTS IN POSTHARVEST FISHERY RESEARCH PROJECTS

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ABSTRACT

The lack of proper planning in postharvest fishery technology (PHFT) research projects has resulted in the failure of several fishery programs in developing countries. The planning of the research involves the identification of numerous constraints that will impinge on both the research program and the transfer of the technology that has developed from the research. In this paper the authors have identify these constraints in the areas of resource, harvesting, transportation, processing and marketing in the fisheries sector. They are a part of the system of interrelated environmental, social, cultural, economic, technological and political factors which can radically affect the success of the applied output of the research.

Introduction

Projects for commercialization of seafood in developing countries are often unsuccessful in achieving intended goals. This lack of success has hindered the development of good research programs which for the most part remain underfunded. These financial restrictions, in themselves, contribute significantly to the failure rate. Clearly, commercialization of seafood requires an adequate applied research base for implementation. In order to successfully apply the research, however, it is necessary that the research be articulated within the system to which it will be applied. In other words, it must fit - it must be appropriate. The economies of developing countries cannot afford inappropriate, expensive research programs irregardless as to whether they are grants, loans that must be repaid, or locally funded. Monitoring and evaluation of the research program must include as a basic consideration the articulation of the research with the entire system within which it will be applied.

When we think of research in commercialization of fish, we usually think of research aimed at converting fish into some kind of product (e.g., canned, dried, frozen, etc.). It is, however, frequently necessary to conduct research on other aspects of commercialization such as preservation in distribution systems, administration of vertically integrated firms, product acceptance, etc. The problem is, however, that research tends to

be focussed on only one part of the entire system. This can be the result of the disciplinary orientation of the stimulator of the research; e.g., a recently returned Ph.D. in food science, or marketing research, or transportation systems, etc. It does not even have to be a recently returned graduate -- sometimes even development agency "experts" are narrowly driven by their own area of expertise, assuming it is sufficient to solve perceived problems. Hence, safeguards have to be built into the systems which plan and make decisions regarding postharvest fishery technology (PHFT) research if the research is to be appropriate. As a first step, it will be instructive to describe two projects, one large scale and the other on a smaller scale to determine differing and overlapping constraints. We will then identify these constraints so that future projects may address these issues in the planning stages to determine their significance for operational feasibility.

Fishery Development Projects

During the later part of the 70's and into the 80's, several fishery projects were implemented that coupled the increase harvest of seafood with the increase of domestic consumption of fresh fish and fishery products (Josupeit 1987). A general theme that developed in these projects was to improve the nutritional status of lower income populations with the production of low cost seafoods. In one program in a Latin American country a commercialization subproject valued at - US\$ 10 million was

integrated into an overall US\$ 100 million project that stressed the industrialization of the fisheries of the country. The marketing subproject goals were as follows: 1) the establishment of 56 retail centers and seven wholesale distribution centers to increase the distribution of seafood products, 2) the marketing of fresh, frozen and processed fish into new areas as well as introducing new products into established areas and 3) the increase in consumption of fish in the country especially among the rural and urban poor. The raw material would be supplied by the existing fisheries and from more than 300 new vessels constructed with program funds. Facilities for distributing, freezing and processing the fish were established through a newly formed government corporation that included retail and wholesale stores and was vertically integrated from capture through to marketing. Research in terms of product development and consumer preference was important for the production of low cost foods targeted for the lower income populations.

Implementation of the project demonstrated that there would be problems from the beginning. Location of the retail and wholesale stores were poorly planned and few marketing incentives were given to the stores' personnel. Supplies from the established and new fleet were inconsistent as financial problems of the parent company eroded the business confidence of both fishermen and middlemen who then distributed their fish through other buyers. The production of new products was hindered by problems in scaling up from the pilot plant to commercial scale

operation. Product quality also suffered as researchers were poorly qualified in the area of food science and product development. The market research was poorly run and only done in large urban areas. Poor coordination between the integrated segments of the overall project assured the failure the projects main goal, i.e. improving the nutrition of the general populace with increased availability of inexpensive fishery products. The net result was the closing of the retail and wholesale centers within two years due to lack of sales. Losses became so great in the commercialization subproject (up to US\$ 6 million per year) that it adversely affected the parent company in its other facets of operation as well. Its overall impact was a negative one for the fisheries as it drained the financial reserves and eroded the confidence of the general public in fisheries products produced within the country.

A smaller, but also problematic project, involving shark was carried out in another Latin American country. The adjacent ocean waters were teeming with shark which were not captured or utilized in any manner by the local populations. Fishery experts felt that this was an opportunity to develop a project which would take an underutilized resource and turn it into food for the population. An international development agency, in cooperation with the country's fishery department implemented a project designed to convert shark into an acceptable product. The conversion of shark into an acceptable product is not simple. Errors in postharvest handling frequently result in an

unappetizing product, and in some areas there are cultural values against eating shark (Adams 1986). In the area of this project, people stated that they would not eat shark because shark eat people. This folk wisdom was underscored by the fact that when one of the authors arrived in the country, at the beginning of the project, there were newspaper articles concerning fishermen who were complaining about the abundant shark that were, at times, bumping their boats and causing much alarm. Stories circulated about fishermen attacked and sometimes killed by the animals.

The project, however, was apparently well designed. It involved development of a product demonstrably acceptable to the local population, packaging and renaming to enhance its acceptability, and televised programs concerning its preparation since it was a dried product and unfamiliar to the local population. Television was an appropriate medium for advertising the product. Most of the country had electricity service, and in the evenings people would gather at local shops to watch television. Even in areas not yet served by electricity, shop keepers aware of TV's attractiveness would operate a set using a small generator which also supplied the shop with light. At the beginning of the televised educational program, however, some minor errors were made. The cooking demonstrations were done on electric ranges, and most of the rural population cooked with wood or charcoal; hence, cooking techniques and times were inappropriate for most of the target population. The project,

however, carried out continuous monitoring and was flexible. The problem was noted and corrected. The product gained consumer acceptability, and the people in the fishing community learned to operate the drying and packaging equipment.

The project seemed to be a viable when the development team left the area. The problem that developed, however, involved inputs to the postharvest processing and distribution scheme. When the project team was in the country, a project supplied "expert fisherman" harvested the shark for processing, using a vessel somewhat larger than the local craft. The local fishermen did not target shark. After the project team departed, the local fishermen still did not capture shark due to various factors including a lack of knowledge concerning shark fishing and a fear of the animal. Since fishermen in some neighboring countries harvested shark using relatively small vessels (some using dugouts no more than 5 meters in length), the project personnel did not anticipate this problem.

Hence, a potentially useful project died because of a lack of attention to sociocultural factors affecting inputs. Shark was traditionally unacceptable as food; thus, the fishermen had no reason to develop shark fishing methods. Additionally, shark were perceived as very dangerous animals, reinforcing the lack of desire to harvest the species. Because shark are sometimes captured as by-catch when targeting other species, and because shark are targeted in some other Latin American countries,

project personnel assumed there would be an adequate supply of shark for the processing plant which they developed. These assumptions were faulty.

These examples highlight an important point about PHFT research projects -- the processes and products being researched do not and will not exist in isolation. They are part of a system of interrelated environmental, social, cultural, economic, political, etc. factors, any of which can radically affect the success of the applied output of the research. Hence, prior to spending relatively scarce manpower, time, and money on PHFT research in a developing country, it is essential that we have an understanding of the matrix of factors which potentially affect project success.

To some this may sound like beating a dead horse, but we have witnessed enough failures in PHFT projects to assume that either this is not general knowledge or it is being ignored at the expense of scarce resources in developing countries. As will be shown, fishery projects are especially problematic due to characteristics of the resource and the product. Hence, using the foregoing projects as a starting point, we would like to identify the complex of factors influencing applied success of PHFT projects and suggest some methods for accounting for them in project design.

Diagnosis of the Projects:

In the diagnosis of the larger project we need to look at four different areas: the planning, implementation, on-going monitoring and evaluation. The planning of a project of this magnitude is the most important phase of the overall project itself. There were several constraints from the beginning that should have been recognized. The planning committee itself consisted of engineers, biologists, economists, lawyers and politicians and was deficient in terms of technologists and marketing analysts. Very little was known about the economic factors influencing seafood consumption in the country. No research had been undertaken to estimate gross characteristics of seafood demand such as own-price elasticities. Predicting the effect of increased availability and deciding what fish products should be developed required an understanding of the patterns of perceptions and preferences for these products. There were few qualified personnel who could undertake these tasks and the planning committee relied on consultants from outside the country.

During this period there was great activity in the fishing industry world wide. On-hand experience in the marketing of increased production of seafood, however, had mainly come from developed countries involving cold water fish species or the Asian region. Little experience in marketing had developed in the Latin American region which had traditionally consumed low

amounts of fish. Outside consultants tended to extrapolate from other regions or theoretical models which were accepted as workable by both the funding and the executing agency. At the time no research to gather accurate base-line data had been proposed as methodologies for doing so were poorly described. Consequently, unrealistic goals such as "improving the level of national nutrition" and "fabricating inexpensive fishery products" were incorporated into the workplan. Goals such as these were later attacked in the popular press when it became obvious that they could not be met.

Failures during the implementation stage were due to both inadequate planning and lack of proper integration into the other sectors of the project. The hinge-pin of a project of this nature is the supply of raw material for distribution in the fresh state and for processing. A significant part of the project involved the construction of vessels that would lead to an increase in the capture of fish to supply the stores. Because of delays in the building of the boats many of them were not on line by the time the commercialization subproject was to begin. Those that were constructed were not utilized to their capacity by the fishermen due to design flaws or unfamiliarity with the fishing techniques required by the vessels. Fish were available from the small-scale sector as this had gone through a different strengthening program. However the financial status of the parent company was such that monies were frequently not available to purchase fish in large quantities nor would the fishermen be

willing to sell to the company on credit since other buyers were available.

The retail stores themselves were poorly operated. Location was a problem as some of them were placed in coastal towns where fresh fish markets were already established and new markets unnecessary. Location of the markets in the largest municipality of the country were ill advised as the city went through a major traffic re-routing during the same period, and several of the stores found themselves on major thoroughfares that prohibited stopping and parking. Few incentives were given to the salaried employees, and they in return showed little interest in the stores or promotional sales. Attempts to compete on the open market were strongly resisted by fish sellers in the private sector who were supported by the Ministry of Commerce and Industry. Once it became obvious to the executing agencies that the marketing of fishery products entailed much more than they were prepared to handle, the project received less and less attention. For the sake of the loan program and in order to demonstrate that proper effort was being made in the marketing sector, more emphasis was given to PHFT research and the development of inexpensive food products. This suffered many of the same problems as the original marketing program. There were inadequate trained personnel to do the necessary technological and socio-economic research. Technology transfer in terms of equipment did not occur because the tunnel freezers purchased to produce the final product were too sophisticated and often broke

down, thus requiring expensive repair and maintenance costs. Market studies for the product were poorly done and did not include the rural poor who were targeted in the original research goals.

The question arises "Could this have been prevented by proper monitoring and evaluation?" Although the overall project would have failed due to problems in the planning and implementation phase, certain components would have fared better if a proper monitoring program had been carried out during the program. The failure to write verifiable reports, fiscal accountability, and a systematic reporting of sales did not allow the project to move in any other direction than the one prescribed in the original plan. This lack of flexibility can be looked upon as a constraint in the field of seafood marketing which is dynamic and subject to monthly fluctuations. Many of the initial problems in the PHFT research project could have been dealt with more expeditiously if the reports had been available and of scientific merit.

The diagnosis of the shark project is relatively simple since it was so nearly successful. For the most part, planning was adequate. There was apparently a sufficient resource of shark which was unutilized. Market research indicated that dried shark would be acceptable if the name was changed; the drying and packaging technology was well developed and appropriate; and a channel existed for distribution and marketing of the product.

The basically good planning facilitated implementation, and monitoring was adequate to determine that the initial extension programs on television were inadequate due to inappropriate cooking methods and the program was changed. For some reason, however, monitoring was not sufficient to pick up the fact that the local fishermen were not involved in capturing shark; hence, a problem existed at an unexpected point in the chain from the sea to the consumer -- the fishermen did not know and did not want to learn how to capture shark. Although the planning was basically good, it failed to include a provision for determining whether or not local fishermen could maintain the needed level of supply of shark for the processing, distribution, and marketing system developed by the PHFT research.

Identification of Constraints to PHFT Research Projects

The above examples indicate that a problem anywhere along the chain from the resource to the consumer can result in the failure of the application of a PHFT research project. This observation suggests that it would be useful to develop a diagnostic methodology that treats each element along this chain.

The basic elements along this chain include 1) the resource; 2) the harvesting sector; 3) the transporting sector; 4) the processing sector; 5) the marketing sector which includes the consumer and is shown in Figure 1. Following sections identify

Figure 1

Postharvest Fishery Research Constraints

Resource → Harvest → Transport → Process → Market

1. endogenous effects	1. fishermen's attitude	1. mode of transport	1. human resources	1. traditionalism
2. exogenous effects	2. ice, off-loading & storage	2. variable supply	2. production costs	2. lack of analysis
3. sustainable yield	3. tropic environment	3. established dist. chain	3. quality control	3. high cost of fish
			4. appropriate technology	

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constraints to the application of PHFT research projects which are associated with each of the elements in the chain.

The Resource: In contrast to most food technology projects, those based on capture fisheries are dependent on a difficult to predict, highly variable supply. Catches vary from day to day, month to month, and year to year. Some variations are due to local weather which influences fishermen's fishing activity; others are due to variations in the locations and quantities of the fish stocks resulting from climatic/oceanographic changes (e.g. El Nino), periodic migrations, pollution, and effects of fishing activities on the stocks. Applied aspects of PHFT research must be planned with these variations in mind.

Perhaps one of the biggest errors regarding the resource a PHFT research program can make is assuming that observed or reported abundance of targeted species can be projected into the future. It has become quite clear that fish stocks, especially tropical reef fishes, can be rapidly depleted by increased harvesting pressures (Roedel and Saila 1979). A research program aimed at developing systems for processing, marketing, and distribution of a given species may result in a quite attractive technologically, economic, and socially feasible development scheme. The project could be implemented and operated successfully for a year or two, only to fail after the stocks are depleted to the point that their harvesting is no longer economically feasible. The bottom line is that it could be

wasteful to conduct applied PHFT research on a species without first obtaining information concerning the status of the stocks along with a projection of the sustainability of the resource under the level of exploitation projected necessary to fulfill potential project objectives.

The Harvesting Sector: A basic consideration with respect to the harvesting sector is whether or not the sector can provide sufficient product to support the PHFT projected to result from the research. While a big industrial fleet targeted at the desired species and vertically integrated into the entire harvesting, processing, and marketing system might be able to provide sufficient inputs as long as the workers continued to work and the resource remained at an appropriate level, the output of numerous small-scale entrepreneurs in a developing country's artisanal fishery is a bit more difficult to predict. Typically the small-scale fishery in a developing country is composed of a number of independent boat owner-operators who target species that they have the knowledge and gear to harvest and for which they can receive the best prices. They are businessmen -- they will change target species if their calculations tell them they can afford the switch and will have a greater return for their efforts. An outside expert's demonstration is frequently insufficient motivation for such a switch. The assumptions concerning the production of the raw materials by the harvesting sector must be carefully examined (e.g., the shark project), especially if the species is

previously unexploited or "underexploited." There are frequently social, cultural, and/or technological reasons for the traditional level of exploitation.

Sometimes the proposed PHFT requires a quality of fish not achieved by traditional harvesting methods. For example, in tropical waters the fish have frequently started to decompose before they are even taken from the net. Additionally, these fisheries often do not use ice; hence, fish reach the shore in a less-than-fresh state. While this may be adequate for the traditional processing (if any), distribution, and marketing system, it may not be acceptable for the system resulting from the applied research. PHFT research that extends the shelf-life of seafood will have minimal impact unless extension training occurs at the beach level. This has been largely neglected in the past and several fishery development projects have failed because training was aimed at middle management and not at the fishermen. It is then necessary to ask if changes to insure acceptable quality are feasible given the traditional situation; e.g., can or will the fishermen pull their nets more frequently, is ice available, will the fishermen use it (will it reduce the vessels payload?), can they afford refrigeration or ice, etc. If not, the fish supplied will be of lower quality than that assumed by the applied research which could make the research findings inappropriate, suggesting that the PHFT system developed from the research will not produce the expected products.

The Transporting Sector: This sector involves all those involved in moving both the raw material and the processed fish product. Small scale fishing communities differ with respect to the development of this sector. In some, fish is unloaded from the vessel and sold directly to the consumer by the fishermen. In others, retailers meet the vessel and take the fish to their marketing locations by foot, bicycle, or motor vehicle of some sort. In others yet, middlemen (wholesalers) transport the fish from the beach to the retailers. Some fisheries have quite complex division of labor which includes specialists carrying fish from the vessel to individuals who transport the fish to processors or middlemen, who then hire other transporters to take the fish to the retail or larger wholesale markets. It is obvious that for a specific PHFT technology to succeed it must have an appropriate (e.g. in terms of size and handling) link with the harvesting sector and the markets. With respect to size, it must be capable of handling the necessary supply, and the handling must be adequate to deliver an acceptable raw material to the processor and product to the marketplace. Projected changes deemed necessary must be technologically, economically, and culturally feasible.

The Processing Sector: Research must pay attention to aspects of the existing processing sector. This is especially true if the applied research is directed at replacing or improving traditional techniques. The applied research must be influenced by the abilities, both physical and intellectual, of those

presently employed in processing. For example, are the techniques too complex for existing educational levels? Are the physical demands of operating the equipment beyond the abilities of those traditionally employed in the sector?

The research must also be influenced by the projected costs of materials and equipment involved. Will the process developed demand scale-up equipment beyond the present purchasing power of traditional processors? If yes, is there any likelihood for access to loans or subsidies? These and other factors of importance in the transfer of new processing technologies (Morrissey 1988, Pollnac 1978) should be routinely evaluated as a part of developing PHFT research programs involving the processing sector.

The Marketing Sector: Marketing in small-scale fisheries ranges in scale from fishermen directly bartering surplus catch for another good (e.g., rice or some other agricultural product) to complex systems involving numerous middlemen (buyers, sellers, etc.) spread over a wide area including large urban and widespread rural markets. Applied PHFT research must have a clear understanding of the operations and functions of these existing marketing systems. If the research involves improvement of quality, some of the changes will undoubtedly involve participants and practices in the existing marketing system. As with the analysis of the processing sector, it is important to be sure that the proposed changes resulting from the PHFT research

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