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Improvement of the fish production chain  
and the increase of added value\*

Prepared by the  
UNIDO Secretariat

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## SUMMARY

The purpose of this document is to identify the major problems relating to the handling, processing and marketing of fish and fish products in developing countries, with the object of promoting discussion about the possible ways of overcoming them and of securing increased added value in the products by means of international co-operation.

It should be mentioned that the range of processing activities in the developing countries extends from the craft level to that of large-scale industrial activities, with a whole series of intermediate situations. This variety is to be noted not only when different regions are compared but also, in many cases, when individual countries are considered.

Broadly speaking, processing activities can be distinguished, according to the destination of the products, as those of the industrial type, geared mainly to export, and as small-scale activities, the products of which are intended mainly for the local market. The problems arising with regard to the training of manpower, technology transfer, equipment, product development, packaging, etc. differ fundamentally in the two cases.

Shortcomings in the infrastructure for the handling of fish, both on landing and on transfer to processing centres and centres of consumption, have been identified as constituting a problem common to almost all the developing countries. In many regions, shortcomings at this level range from shortage of ice and the absence of suitable containers to scarcity of drinking water.

As regards the development of products and technologies, it is to be noted that, in general, the introduction of new technologies into the developing countries has been prompted by external demand, and that those technologies need to be adapted to local conditions. Greater efforts are therefore required to improve technologies in small-scale production (e.g. by energy savings) and to carry on with the work already begun, bearing in mind that, for many developing countries, the local market can only be supplied by products of the craft type. The need for improving the ways in which products are presented and the problem of cans and containers have been identified as common to most of the countries in question, with respect both to canning and to other forms in which the products may be presented.

Lastly, with regard to the improvement of quality control standards, attention is drawn to the need for producers to work in all cases with the governments concerned, this being particularly necessary to improve and maintain the quality of products for export.

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THE HANDLING, PROCESSING AND MARKETING OF FISH  
IN DEVELOPING COUNTRIES AND THE PRINCIPAL  
BARRIERS TO IMPROVEMENT

I. OUTLINE OF FISHERIES PRODUCTION - PRODUCTS

1. As shown by the reports on the three regions described at the Preparatory Meetings for the First Consultation on the Fisheries Industry, developing countries with important fishery activities show the following characteristic features: on the one hand, there is considerable internal demand for low-price products and, on the other hand, support is given to exports as a means of generating foreign exchange. This means that production is able to supply contrasting markets with products that are totally different in terms of their consumer appeal, added value and requirements regarding taste, hygiene and presentation (packaging).

2. Besides fresh fish for immediate consumption, a range of industrial products for export and a range of industrial and semi-industrial (craft-type) products to supply the internal market, are thus in many instances being developed.

3. This gives rise to the co-existence of different forms of production around a single landing centre. Hence the difficulty in getting new technologies adopted often lies not in any lack of knowledge of them, but rather in the need for careful adaptation of them to the various scales, cost breakdowns and, primarily, markets to which products are sent. This gives rise to problems relating to the adoption of the appropriate technology for each situation or production cycle and the training of the individuals who have to implement it, as well as their financial and business management capability.

(a) Industrial products for export

4. Although the production of each country or region may differ from others, the need to satisfy the specifications of the international market means that most industrial production falls into the categories covered by the following list:

- Canned products;
- Frozen products;
- Prepared and semi-prepared dishes and pastes;
- Fish meal and fish oil;
- Protein concentrates and special products;
- Fresh fish.

5. Over the past decade, the export of canned products from developing countries, and especially from some countries in Asia, Latin America and North Africa, has increased very considerably. This has been due to various factors such as the existence of raw materials, changes in the profitability of the fish-canning industry in the main consumer markets, the fact that there is a tradition of producing canned goods in the exporting countries, and so forth. None the less, this possibility has not been generally used, since in many countries difficulties are still encountered in adapting production to the varying new market opportunities.
6. Frozen products also play an important role in fisheries exports in some developing countries, especially as regards tuna, shrimp, lobster, squid and white fish. In this area there are extensive opportunities for improvement in the standards of quality and presentation of products.
7. In the field of prepared and semi-prepared dishes and pastes there are many possibilities depending on the way in which market requirements develop. If advantage is to be taken of these opportunities, however, it must be possible to identify them by means of appropriate market information machinery, and to have the necessary technical flexibility to develop the products required.
8. The production of fish meal and oil is largely based on the use of small pelagic species. Although it would be desirable to use more of the supply of these species for direct human consumption, it must be recognized that there are not always markets for them or that they cannot be dealt with industrially and marketed economically. The production of meal and oil has been an important source of income for a group of developing countries, although at the present time the international market in fish meal is being affected by competition from other types of protein meals. Prospects for the future would therefore seem to lie in making better use of the resources for direct consumption and in developing special meals. For this, a good knowledge of the market and in some cases new technologies will be required.
9. The transport by air to certain markets of fresh fish belonging to very high-value species offers the possibility of marketing small quantities of products and obtaining very good prices, which opens up encouraging future prospects for this activity, currently being developed.
10. The future of the so-called "protein concentrates", types A or B or simply fish meal for human consumption, seems doubtful given that there are more appropriate economic alternatives for the direct utilization of fish and strong competition from high-protein meals of vegetable origin.

(b) Products obtained by small-scale operations for domestic supply

- Fresh fish, whole or in cuts, etc;
- Dried, salted and dried, cured products;
- Smoked products, with or without salting and/or drying;
- Fermented products, sauces, marinades and regional products;
- Canned products for internal consumption;
- Frozen gutted whole fish, cuts, etc.

11. The above list attempts to group a very large number of different sorts of products which may be found in developing countries. There is a greater variety of regional products in Asia and less in Latin America. There is not so much diversity in the types of products in Africa but some of them are produced in very large quantities, as for instance smoked and dried fish.

12. The category of products obtained by decrease of water content, by chemical modification or by fermentation processes, offer advantages as compared with frozen and chilled products and also as compared with canned products. The technologies in question involve less investment, less energy cost and can be applied on a small scale.

13. Salted, dried and smoked products are the types whose production can be improved in many areas, mainly in Africa. In particular it is necessary to reduce the losses occurring during processing, storage and distribution in consequence of attack by insects. In this connection there are great possibilities for collaboration among countries in the same region to secure better pooling of technology.

## II. HANDLING AND PROCESSING

14. Various types of handling and processing are to be found in the developing countries as a whole, ranging from simple small-scale fishery activities, often difficult to distinguish from subsistence fishing, to modern industrial systems comparable with similar systems in developed countries, with a whole range of intermediate possibilities, often coexisting simultaneously. The success achieved in various developing countries with activities of the industrial type has been due to a variety of reasons, among which mention should be made of the existence of raw materials, the identification and/or development of markets, the presence of qualified manpower and industrial experience in similar activities. There have also been failures due to inadequate planning, uncertain policies and inadequate training, including management training.

15. Widely differing situations may also be found even within the same country, as a result of a combination of planning mistakes and failures or of differences in the assimilation of technologies by the various people intended to use them. Those engaged in small-scale "craft" production frequently show resistance to the possibility of positive change through failure to appreciate its advantages due to inadequate preparation of the social environment and technical training.

16. A problem shared by almost all developing countries, with differences from one region to another, is the deficiency of the infrastructure for the handling of fish when it is landed, and delay in its despatch to the factories for industrial processing. It is common, in some regions, for there to be not enough ice, suitable containers, cold storage or even drinking water available at this stage. Similarly, there are serious deficiencies in transportation to the locations where the resource is used for processing or sale.

17. Production of the industrial types is affected, in many developing countries, by the shortage of spare parts for machinery and plant. This problem is aggravated in the present economic situation by the shortage of foreign currency. The maintenance of machinery and plant is thus found to be defective, especially in those countries which are short of specialized manpower. It is also noticeable that the efficiency of machinery and plant from the point of view of its use and energy consumption, is in many cases far below the level of efficiency achieved with the same machinery and plant in developed countries. This applies particularly to the production of ice and the storage and transport of fresh and frozen fish, with consequent increases in costs.

18. If we look at the various processing and value-adding activities separately, some of the salient features are as follows:

19. Canning. In the three regions, there are relatively small plants and also very modern plants with large-scale production. Above all, during the past decade, there has been an expansion of the canning industry in the developing countries, in many cases directed to the export market but sometimes also to the domestic market or in pursuit of several aims simultaneously. This development has certainly not been homogeneous and in many countries there are still problems as, for example: shortage of raw material in adequate quantities or of suitable quality, too small a market for the size of the undertaking, difficulties in meeting the quality requirements for foreign markets etc. At the present time, the canning industry is



passing through a period of change throughout the world, which may offer opportunity for the developing countries, provided that they are able to adapt to market requirements. The common problem is that of the cans themselves which, as a rule, are of outdated technology and too expensive, thus preventing them from competing more successfully on the international market. In the three regions, attempts are being made to achieve modernization in the direction of using easy-to-open containers, and even flexible containers in Chile, Peru and Brazil. Another factor limiting the quality and competitiveness of some canned products is the quality of the oil available. The problem of the type of cans or the shortage thereof may perhaps be solved by subregional co-operation or by making use of temporary import facilities.

20. Freezing. It is in this branch that the problem of maintenance is most acute, especially in tropical conditions. The range of products and forms of work is very wide. The ice supply normally needed for this activity is insufficient in many countries and the type of ice used is frequently inadequate.

21. The mistaken evaluation often made of the benefits of using a particular type of ice for conserving fish arises generally from the absence of facilities (insulated silos or containers) to avoid ice loss before use. Likewise, the attitude towards fresh and frozen products would change fundamentally if one were able to implement low-cost cold storage chains based on the use of efficient and economical insulated containers. It must be borne in mind here that, if the implementation of these systems is to be economically feasible, a certain scale must be reached in order to justify the application of expensive means of transport and distribution.

22. If products for direct human consumption alone are considered, freezing is the approach adopted for most international trade. The possibilities of this trade have given rise in many developing countries to substantial investments, technological advances and general development in the fisheries sector.

23. Reduction. Reduction to obtain fish meal and oil is the largest activity in Latin America. In Asia there is also extensive production, but the quality does not always meet the highest standards, since the industry uses the accompanying catch which is somewhat carelessly handled and contains large amounts of sand.

24. Overall, this industry is considerably over-sized, mainly owing to the drop in production in Peru and the loss of competitiveness of fish meal in the face of vegetable substitutes such as soya. This is probably the industrial fishing

activity with the greatest degree of standardization and mechanization and in which there are the fewest small-scale undertakings. It is also that which corresponds most to the idea of an industrial activity involving the application of large investments and employing little labour. Most of the fish meal produced by the developing countries is intended to export.

25. Salting and drying. These processes are very important in relation to domestic supply, since they represent, together with smoking, cooking and some types of canning, the only alternative in the absence of cold storage chains. There is much to do in this field to improve traditional practices and to reduce the losses during processing, storage and transport, which are considerable in some regions. The key points are: improvement of sun drying, increased production or availability of salt, improved handling, protection against insects, use of appropriate standards and improvement of packaging. In general terms, the small-scale processing workers are familiar with these technologies, which also form part of the culture of many peoples, but in many instances procedures can be improved in the light of present-day knowledge.

26. It is worth noting that there are real possibilities of enhancing the production, productivity, hygiene and quality of most preserved products. However, it is even more important to note that this can be achieved by using simple methods, with locally-available materials and very little mechanization (if any), while at the same time improving the working and living conditions of the small-scale processors.

27. Smoking. For smoked products of the type familiar in the developed countries the possibilities of expansion in the developing countries are slight, owing to the short time they can be kept and to the need for a chain of cold stores for their distribution. There is, however, one type of product, more correctly described as smoked and dried, produced mainly in Africa, which can be stocked for an adequate time and does not require a cold storage chain. This type of product can be improved by using better techniques and processes, while losses during processing storage and distribution need to be reduced. The introduction of improved smoking ovens and the more efficient use of the wood-fuel employed would contribute to this end.

28. Fermented products. There are traditional techniques in this area, especially in Asia and North Africa. Sauces are produced in Asia which, when suitably packed, are exported. The technology used is based on traditional techniques, but there are also methods developed locally for industrial-type production.

29. If this industrial production prospers and there are improvements in the hygiene conditions for the processing of this type of product, this may be a new and important export item for some countries, especially with the world-wide expansion of oriental cookery.

### III. DEVELOPMENT OF PRODUCTS AND TECHNOLOGIES

30. In general, the introduction of new technologies in developing countries is motivated by external demand for a product for which the technology already exists in the consumer market. It is therefore normally a matter of the assimilation of existing technologies and their adaptation to local conditions. Certain efforts are also being made to develop craft-type technologies which can help in improving living standards in rural communities.

31. Certain countries in Latin America and Asia have reached a level of industrial development which enables them to manufacture refrigerating equipment and processing machinery, containers, etc. not only for their own consumption but also for export. In such cases, the only things that need to be imported are highly specialized electronic, automatic-control and precision-engineering components, such as centrifuges for the separation of water and oil in the production of meal. The developing countries are not, however, taking part in the computerization of production processes and the quality control systems employed are still somewhat antiquated.

32. This systematic adoption and adaptation of technologies to suit local conditions has produced good results in terms of foreign exchange savings, technological independence and independent supply and has led to the improvement of some existing machines and implements.

33. The fact that the technologies and types of products for which there is a demand in the international market originate in developed countries means that there is a fundamental task of adapting them to local conditions. Furthermore, the many activities thus generated lead to increased employment of labour in tasks related to the fisheries industry.

### IV. POSSIBILITIES OF CO-OPERATION BETWEEN DEVELOPING COUNTRIES

34. Considering that the situations encountered in the various countries show very marked differences and that experience in fishery activities is very varied, there are considerable possibilities for technological co-operation between the different

developing countries. For example, in some countries in Asia and Latin America there is a good knowledge of processing techniques that are applicable in other regions and can give very good quality products. Nor should internal transfer of technology be neglected, since there are, in many instances, marked differences between the various regions of the same country.

35. Some countries have experience in the conclusion of international agreements and the establishment of joint enterprises. Others are familiar with aquaculture, the processing of white fish, shrimp and prawn, fish meal, etc: it must be acknowledged that it is not easy to promote the interchange of knowledge but advances in this direction have none the less been made and some regions are more active than others in this respect.

36. There is thus enormous scope for collaboration on the design and adaptation of the technologies most appropriate in each case.

37. A fundamental point in technology transfer relates to the practical training of technical personnel in processing, maintenance and even business management. So far as possible, the training aspect should include the acquisition of knowledge connected with the tasks involved in "managing" an enterprise. Any improvement project along the lines mentioned may depend on this.

38. Likewise, the field of containers and packaging in general offers interesting possibilities for South-South co-operation.

#### V. QUALITY CONTROL AND STANDARDS

39. Experience has shown that, for market purposes, the quality of the fisheries products exported by many developing countries has not been maintained at a steady and consistent level. In consequence, these countries have lost millions of dollars in earnings, due to the detention and rejection of their shipments, and to the low prices commanded by their products in the main world markets because of this lack of consistency and continuity. Programmes for the improvement of quality control and in many cases of hygiene are required, both at government level and at the production level, in order to improve this situation. Such programmes must be well planned and administered and should cover all stages from catching to processing. There are, admittedly, differences between the regions and even among the countries in any one region, and substantial advances have also been made over the last decade. Nevertheless, if they are to derive the maximum economic benefits

and not to be left behind by the latest technical developments and new ideas, the developing countries must renew their efforts to improve the quality of their products, from the standpoints of hygiene, consumer appeal, presentation and labelling.

40. The developing countries have not taken a very active part in formulating the recommended codes of practice for fisheries products. Although these codes are still far from being internationally recognized, they constitute the only integrated body of standards in this respect which has been discussed multilaterally. The developing countries should therefore consider more active participation in the discussions on the Codex Alimentarius (FAO/WHO), so that account may be taken of their views and circumstances in the formulation of standards and codes.

VI. THE PRINCIPAL BARRIERS TO THE IMPROVEMENT OF FISHERY  
ACTIVITIES WITH REGARD TO HANDLING AND  
PROCESSING IN DEVELOPING COUNTRIES

41. Bearing in mind the existing situation in the developing countries, the following comments may be made with regard to the problems those countries have to face in trying to produce more and better products in order to satisfy the demands of the various markets.

- Problems concerning maintenance and technical assistance for the industry.

42. Possibilities for ensuring adequate maintenance of industrial equipment and installations are absolutely essential to ensure the self-sustaining development of the industry in many developing countries, particularly in those of Africa South of the Sahara. Access to such assistance generally depends on government policies, which should take this problem into account. In principle, fishery activities should be enabled to obtain the external assistance needed, while local teams of technical experts are trained. Similarly, efficient circuits must be established for the prompt supply of spares and components.

- Continuous supply of electricity, water and fuel.

43. The development of industrial activity relating to highly perishable products is impossible unless these inputs are reasonably guaranteed.

- Absence of service infrastructure.

44. Self-sustaining fisheries undertakings are impossible unless there is a basic infrastructure for the supply of water, channels of communication, transport, national and international communications, etc: it should be noted that, in many cases, there are shortcomings in the internal distribution of fisheries products and that the wholesale and retail markets are inadequate.

- Need for appropriate technologies and economic scales.

45. Any development and/or modernization of fishery activities must pay close attention to these two aspects to ascertain to what extent conditions can be improved by the appropriate application of existing techniques and approaches and to what extent it is really necessary and advisable to introduce new techniques, equipment and mechanization.

- Supply of raw material and basic inputs, such as salt, ice and cans.

46. There are numerous examples of the results of making large investments in modern installations without a sound foundation with regard to the provision of raw material and such basic inputs as cans, ice and salt. It is often necessary to plan the development of fishery activities and of ancillary industries simultaneously.

- Absence of an infrastructure to land the catch and handle it on shore.

47. A point which should be mentioned is the absence of facilities to improve the handling, landing and collection of the fish, not only in the case of small-scale fishing but very often in that of industrial fisheries. This affects the entire subsequent cycle and increases fish losses. In many instances, the provision of very simple installations could provide a substantial improvement in the situation.

- Inappropriate handling.

48. Although the absence of an adequate infrastructure causes handling problems, handling can also be improved by educating the people involved so as to avoid practices which may be prejudicial to the quality of the products.

- Lack of storage installations for materials and products.

49. It is, in many cases, common knowledge that facilities of this type are lacking, both at the locations where catches are landed and at the distribution centres, as well as in the fishing communities. Losses are consequently caused by climate, insects and dirt. In the case of craft-type products, where the preserving method is associated with decrease of water content, there are possibilities of improving storage conditions by using simple approaches within the means of the fishermen.

- Need to diversify export products.

50. Producers must strive to avoid excessive dependence on a single market or a small number of markets or products, in order to achieve greater security.

- Technological dependence.

51. The processing know-how and even the necessary machinery and equipment are very often purchased from the same countries that buy the final products. This leads to a situation of dependence calling for efforts to reduce it. Complete independence will not be possible, as communication and unimpeded dialogue between the exporting and importing countries is desirable.

- Lack of technical training.

52. In many countries, there is a need for trained personnel at all levels of fishery activities. Efforts must be made to form an initial nucleus of technicians who can then pass on their knowledge and to develop a policy for promoting the transfer of knowledge from research and training institutes to the production sector.

- Need to improve salted, dried, smoked and fermented products.

53. Some traditional production techniques do not result in products which are stable from the points of view of hygiene, keeping qualities or nutritive properties. It is therefore necessary to review the methods and the final properties of the products to tailor them to requirements in each case.

- Need to establish the correct scale for each branch of activity.

54. One problem frequently encountered is the lack of information for determining the size of a given undertaking by reference to the available fisheries resources or for avoiding the risk of production on an uneconomic scale.

- Absence of official quality and health control in many countries.
- Inadequate development of can-making technology and production.

55. One important advance which should be achieved in the future would be the refinement of the ways of packaging products obtained on a small scale and using craft-type methods; such products suffer severe losses, partly because they are inadequately packaged.