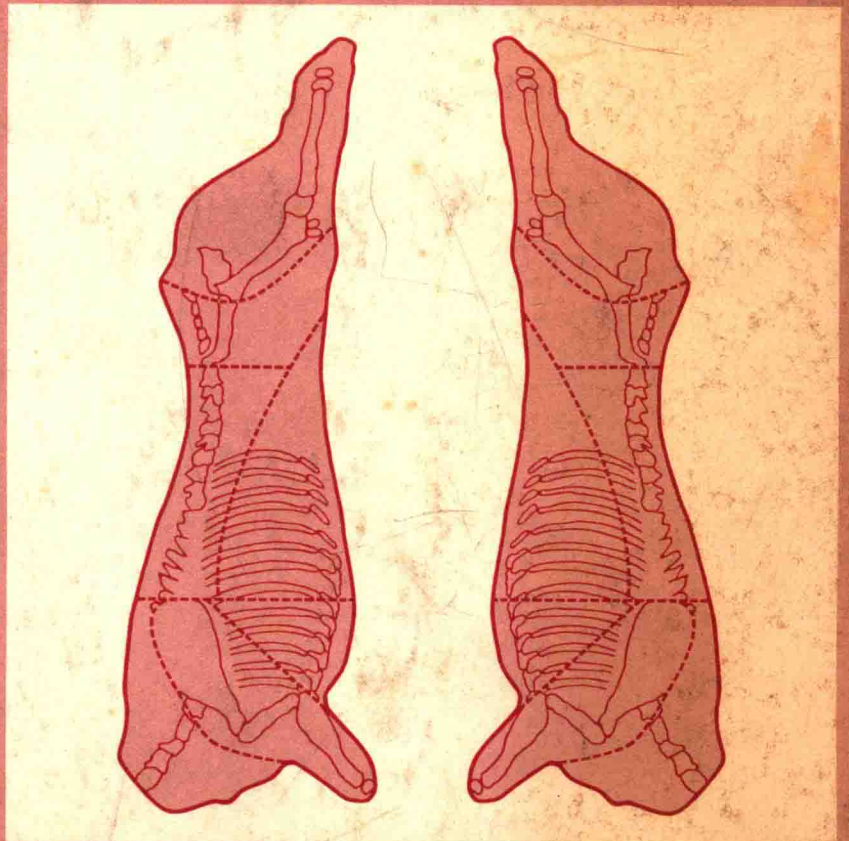


Small-scale processing of beef



Prepared under the joint auspices of the International Labour Office and the United Nations Environment Programme



World Employment
Programme

International Labour Office Geneva



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ISBN 92-2-105050-5

ISSN 0252-2004

First published 1985

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PREFACE

This technical memorandum is the fifth in a series of publications dealing with food processing technologies¹. The object of the series is to acquaint small-scale producers with alternative production techniques for specific products and processes with a view to helping them to choose and apply those techniques which are most appropriate to local socio-economic conditions.

A large number of developing countries raise cattle but continue to import large amounts of processed beef (i.e. corned beef). It is estimated that products worth over US\$170 million are imported by developing countries each year, mostly from industrialised countries. Yet developing countries are perfectly capable of processing their own beef, thus saving scarce foreign exchange and generating much needed new employment opportunities. Furthermore, the local manufacture of beef products should better take into consideration local tastes and customs and the purchasing power of potential consumers of these products.

There are many reasons which may explain the large imports of processed beef products by developing countries and the limited production of these products by local meat processors. Interested readers will find a brief analysis of these reasons in Chapter I. One such reason seems to be the lack of information on small-scale beef processing technologies. It is hoped that this memorandum will help bridge this information gap and will induce the local processing of beef in small-scale plants or as part of a butchery business.

¹ Published memoranda on food processing cover the following products: oil extraction from groundnuts and copra, small-scale processing of fish, small-scale maize milling and small-scale processing of pork. Three other memoranda are at various stages of preparation: small-scale fruit processing, small-scale vegetable processing and small-scale grain storage.

This memorandum covers the production of seven types of standard beef products: biltong, charqui, fresh beefburgers, various types of cooked and cured beef, chili con carne, frankfurters and beef cervelat. Recipes and processing techniques are described in detail for the above types of beef products. These may be easily adapted for the production of other local specialties not covered by this memorandum (e.g. through the addition of other ingredients or small variations in the various processing stages). Thus, with few exceptions, this memorandum should be of interest to the majority of beef processors in developing countries.

The scale of production described in this memorandum does not exceed 2 tonnes of product per week. Production units with an output equal to or lower than 2 tonnes per week are defined as small-scale units. This is an arbitrary definition which does not take into consideration special circumstances under which beef processing is carried out in various countries. Thus, units producing 2 tonnes of processed beef per week may be considered medium-scale units in some countries or "micro units" in other countries. However, from a purely technological point of view (i.e taking into consideration available meat processing equipment), the upper limit for small-scale meat processing units is approximately 2 tonnes of product per week.

The processing techniques described in the memorandum are fairly simple and do not require automated or highly sophisticated equipment. However, most pieces of equipment are equipped with a small electric motor in view of the very low productivity of manually operated equipment. Unlike the other technical memoranda, no list of equipment suppliers is provided in this memorandum. The reason for this is that there is a very large number of meat processing equipment suppliers which are represented in most developing countries. Readers who may face difficulties locating equipment suppliers can obtain names and addresses from one of the directories or journals listed at the end of the memorandum.

Beef processing may be operated as an entirely separate and independent business or may be an integral part of a slaughterhouse complex or of a butchery business. In general, circumstances (e.g. volume of demand for beef products, location of production) will favour one or the other

organisation of production. However, this technical memorandum focuses on the establishment of beef processing units operating as separate businesses. This choice is made in order to facilitate the exposition of the various technical factors and requirements of beef processing and to allow for a separate assessment of the viability of a projected plant. However, the information provided should allow, with some adaptations, the assessment of the technical and economic feasibility of processing units attached to a slaughterhouse or butchery business.

Two chapters of this memorandum (Chapters I and VI) are of particular interest to public planners, project evaluators from industrial development agencies and financial institutions. Chapter I analyses demand and supply of processed beef in developing countries, including imports of beef products and reasons for the limited supply of locally processed meat. Chapter VI evaluates the effects of alternative meat processing technologies on employment generation, foreign exchange savings, capital expenditures and rural industrialisation. A special section of this chapter is also devoted to the effects of alternative technologies on the environment, especially in relation to the disposal of wastes generated by small-scale and large-scale plants. These two chapters should help public planners to formulate policies and measures in favour of appropriate scales of production and meat processing technologies.

The remaining chapters (Chapters II to V) are of particular interest to small-scale meat processors. Chapter II describes the main raw materials (meat cuts, casings, spices, etc.) used in the manufacture of beef products, while Chapter III describes the various pieces of equipment used in meat processing and provides some guide-lines for the design of a meat processing unit, including a suggested plant layout. Chapter IV describes in detail the techniques used for the production of the selected beef products, including the recipe for a given batch of products and a description of the various processing stages. Finally, Chapter V suggests a methodological framework for the evaluation of alternative scales of production and processing technologies. This framework is applied to two production models for illustrative purposes.

A questionnaire is attached at the end of the memorandum for those readers who may wish to send to the ILO their comments and suggestions on the content and usefulness of this publication. These will be taken into consideration in the preparation of future technical memoranda.

This technical memorandum was prepared by the Tropical Development and Research Institute (London) in collaboration with Mr. M. Allal, staff member in charge of the Technology Series within the Technology and Employment Branch of the ILO.

A. S. Bhalla,
Chief,
Technology and Employment Branch.

A C K N O W L E D G E M E N T S

The publication of this technical memorandum has been made possible by a grant from the United Nations Environment Programme. The International Labour Office gratefully acknowledges this generous support.

Figures III.2, III.3, III.4, III.5, III.6, III.9: (c) British Crown Copyright, courtesy of TDRI.

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CHAPTER I

SMALL-SCALE BEEF PROCESSING IN DEVELOPING COUNTRIES: SOME GENERAL CONSIDERATIONS

The purpose of this chapter is briefly to analyse demand, production and trade of processed beef in developing countries, to identify the various types of organisation of production in the beef processing sector, and to indicate the scales of production, processing techniques and beef products covered by this memorandum.

I. DEMAND, TRADE AND PRODUCTION

I.1 Imports of processed beef by developing countries

Comprehensive information is not available on production and consumption of traditional meat products in developing countries. However, trade statistics indicate that steadily expanding markets for many kinds of meat products exist in these countries. Total imports of processed meat by all developing regions are substantial and rapidly growing (see table I.1). They averaged 131,000 tonnes per annum for the period 1965-69 and 170,000 tonnes per annum between 1970 and 1974, and exceeded 200,000 tonnes per annum by 1977. Total value of processed meat imports increased from an average of US\$106 million in 1965-69 to US\$401 million in 1978, although an estimated 80 per cent of this increase is attributable to inflation.

Apart from bacon and 'bone-in' ham, it is difficult to ascertain the animal derivation of the imports shown in the table. However, estimates for the second half of the 1970s indicate that about 43 per cent (by value)

Table I.1
Imports of meat products by developing countries, 1965-78
(Average per annum)

Product	SITC (R2)	1965-69	1970-74	1975	1976	1977	1978
(in thousands of tonnes)							
Canned or prepared meat	014.9	84	118	139	136	153	149
Bacon and ham	012.1	24	25	24	24	22	24
Sausages	014.2	14	17	17	17	20	22
Other dried, salted, smoked meat	012.9	9	10	12	16	14	12
Total		131	170	192	193	209	207
Total value		106	183	295	311	370	401
(in millions of US\$, mainly c.i.f., 1984 prices)							
<u>Source:</u> FAO Trade Yearbook (see Bibliography)							

of total developing country imports of meat products are based on beef and 53 per cent on pig-meat, although these percentages may vary appreciably from year to year. The remainder (about 5 per cent) are based mainly on meat from sheep, goat, poultry and game. Thus, developing countries could have saved, in 1978, the equivalent of US\$172 million in scarce foreign exchange had they processed their own beef. Since most of these imports came from developed countries, the above gross savings would not have been made at the expense of other developing countries. In fact, actual net saving in foreign exchange to developing countries would have been lower than US\$172 million (in 1978) because additional imports, mostly from developed countries (e.g. processing machinery, packaging materials, animal feed), would have been necessary for

the local processing of beef. However, even though an accurate estimate cannot be made, significant net savings in foreign exchange could probably be achieved by some developing countries if processed beef is produced locally instead of being imported.

I.2 Processing of beef in developing countries

Despite the fact that some developing countries raise considerable numbers of cattle, meat processing plants have not developed on a large scale. A few exceptions to this situation mainly relate to large-scale canning operations. Major developments have been confined to the processing of beef in some countries of South America and, to a lesser extent, of Africa. In the past, plants tended to be owned by foreign firms and production was primarily for export. While this situation is changing in favour of local ownership, most beef is still produced and consumed locally in developing countries, either fresh or as distinctive products of traditional preservation processes (e.g. biltong, charqui).

However, the considerable volume of imports of processed beef by developing countries suggest that the latter could considerably expand production in order to satisfy local demand. What may, therefore, explain the lack of response from local meat processors? One explanation could be the characteristics of imported beef products (e.g. beefburgers). In general, these require high quality raw materials and are much more difficult to manufacture, store and distribute than traditional products since they are more susceptible to bacterial spoilage during processing and storage. An accurate control of cooking temperatures and times as well as the maintenance of an appropriate storage temperature are critical. High standards of hygiene at all stages of production and distribution are also essential. Thus, potential beef processors in developing countries may have been reluctant to invest in projects requiring a level of expertise which is not available locally. Another explanation could be that sufficient supplies of beef of the required quality may not have been forthcoming. Other factors may also have contributed to the lack of response to demand for processed beef: attempts at import substitution may have failed as a result of a retailer's bias against locally produced beef products; local producers may not have been sufficiently competitive vis-à-vis imports; or financial institutions may have been reluctant to provide credit for investments in this sector.

The above constraints, which slow down the expansion of beef processing in developing countries, can be overcome if various measures are implemented in order to ensure sufficient supplies of good-quality raw materials and the adoption of appropriate processing techniques by potential meat processors. Some of these techniques are described in this memorandum, including detailed information on a variety of processed beef products which are currently imported by a large number of developing countries.

II. ORGANISATION OF PRODUCTION

A beef processing unit may be operated as an integral part of a slaughterhouse complex or of a butchery business, or as an entirely separate and independent enterprise. Market demand and circumstances determine the type of processing units which may be established in a country.

The integration of a beef processing unit into an existing slaughterhouse complex or butchery business offers a number of advantages. For example, a butcher may supply a segment of the local market with processed beef products made from edible meat trimmings. In this case, the value added may be substantial while additional expenditures may be limited to a few raw materials (e.g. salt, spices, casings) and low depreciation costs for the equipment (e.g. a hand-operated mincer). The extra labour may be provided by the butcher himself or a helper during idle periods. Similarly, the integration of a beef processing unit within a slaughterhouse may be advantageous in view of various economies of scale associated with this arrangement. These advantages do not mean that a beef processing plant operating as an entirely separate business cannot be viable or be as competitive as the other types of plants. A sufficiently large scale of production and demand for specific processed beef products may justify the establishment of a processing plant as an entirely separate business. Such plants operate profitably in a number of developing and developed countries and produce a large variety of beef products.

Although various approaches may be viable, this technical memorandum focuses on the establishment of beef processing units operating as separate businesses. This choice is made in order to facilitate the exposition of the various technical factors and requirements of beef processing and to allow a separate assessment of the viability of a projected plant. However, the information provided should allow, with some adaptation, the assessment of the technical and economic feasibility of processing units attached to a slaughterhouse or butchery business.

III. SCALE OF PRODUCTION, MEAT PROCESSING TECHNIQUES AND RANGE OF PRODUCTS

Meat processing technologies have greatly benefited from recent research and development in food preservation techniques, equipment design and computer-based automation. For example, some of the newly established large-scale plants are equipped with automated machines controlled from a computer room manned by highly skilled operators. Very few workers operate the machines or come into contact with the raw materials between the time these enter the plant and that at which they leave it as packaged meat products. Small-scale producers have also benefited from recent technical developments. For example, it is fairly common for a butchery business in a developed country to make use of meat grinders equipped with a temperature control system in order to avoid the overheating of meat during grinding.

The choice of scale of production is, to a large extent, a function of local and foreign market demand and the amount of beef available for processing. Developing countries which produce large amounts of meat may establish large-scale meat processing plants if most of the production is geared for export. These plants must, of necessity, use capital-intensive technologies in view of the stringent quality control, product uniformity and high level of hygiene required by importers from industrialised countries. In many cases, the need for high technical performance and sophisticated marketing forces some developing countries to allow foreign investments or joint ventures whenever they wish to export processed meat products to industrialised countries.

While the establishment of large-scale, capital-intensive plants may not be avoided whenever production is intended for export, small-scale, relatively labour-intensive units may be preferred if production is intended for the local market. In general, the limited demand for processed meat in developing countries, the high cost or lack of adequate transport facilities (e.g. road infrastructure, refrigerated trucks or wagons) and the limited supply of fresh meat within a given area point in favour of the establishment of such small-scale units. Furthermore, the latter contribute to important development objectives such as employment generation and the improvement of the balance of payments (see Chapter VI). For these reasons, and given the main purpose of the technical memoranda series, this memorandum provides detailed technical and economic information on small-scale beef processing