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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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POTENTIAL CONTRIBUTION OF THE AGRO-FOOD INDUSTRY TO FOOD SECURITY SYSTEMS: THE CASE OF A LATIN AMERICAN SUBREGION

Sectoral working papers series

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SECTORAL WORKING PAPERS

During the course of work on major sectoral studies by UNIDO's Division for Industrial Studies, several working papers are produced by the Secretariat and by outside experts. Selected papers that are believed to be of interest to a wider audience are presented as Sectoral Working Papers. These papers are more exploratory and tentative than the sectoral studies. They are therefore subject to revision and modifications before incorporation into the sectoral studies.

Preface

This document was prepared by the Sectoral Studies Branch of the UNIDO Division for Industrial Studies as a background paper for the workshop organized jointly by UNIDO and the Board of the Cartagena Agreement in Lima, Peru, from 4 to 9 November 1985 on the Programming Development of Priority Subsectors of the Food-processing Industries Within a Food Security System.

The paper defines the concept of food security, briefly discusses the situation of the Andean agro-food industry and shows the potential contribution of the industry to the achievement of food security objectives. There is also discussion of the criteria and conditions which the industry should consider in order to operate efficiently within food security schemes.

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EXPLANATORY NOTES

References to dollars ($) are to United States dollars, unless otherwise stated.

A comma (,) is used to distinguish thousands and millions.

A full stop (.) is used to indicate decimals.

Use of a hyphen between dates (e.g., 1960-1965) indicates the full period involved, including the beginning and end years.

Metric tons have been used throughout.

The following forms have been used in tables:

A dash (-) indicates that the amount is nil or negligible.

Totals may not add up precisely because of rounding.

1. INTRODUCTION

The Andean food security system has been using an integrated approach which takes account of economic relationships between the food production process and food consumption by the population as a whole. In the context of this system, countries have made significant advances in identifying and selecting basic foods and have initiated the activities necessary for designing projects and farming programmes aimed at promoting the production and consumption of these basic foods. The Board of the Cartagena Agreement (JUNAC) and UNIDO took the view that it would be of interest to study the responsibility of the agro-food industry in the design of production and consumption systems for achieving food security objectives and to establish a reference framework for programming the development of priority agro-industrial sectors within this scheme, before promoting the establishment of specific agro-food industries.

This workshop on the programming of priority subsectors of the food-processing industries within a food security system is the first joint JUNAC/UNIDO activity aimed at achieving this objective.

The Andean Pact already has a methodology for analysing and programming industrial subsystems in the design of production and consumption systems. This workshop is intended to produce guidelines and methods for identifying priority subsystems for the food security system, which will be evaluated and programmed using the above methodology.

Subsequent joint activities will be based on the results of the workshop, whose objectives include the establishment of guidelines and bases for a subregional work plan for programming the agro-industrial component of the system, and the identification of the technical assistance required by national food security groups in order to carry out programming tasks.

This paper is intended to contribute to the discussion of the subject by providing background and information on the agro-food industry in the Andean Pact countries and in other regions and by providing a preliminary analysis of its potential contribution to the food security system. The paper proposes a number of criteria and conditions which the industry in the subregion should take into account for operation within the system and in order to contribute effectively to feeding the target population.

The possibility that the industry would fulfil the conditions required by the food security system is illustrated in the paper by pointing out a number of positive experiments noted in the industrial sector in the subregion and technological options whose economic and nutritional impact has been analysed recently at subregional level.

In compiling this paper, considerable use has been made of books and papers of Andean origin, a large proportion of which were produced by the countries, with JUNAC co-ordination, in the context of the activities of the Andean Technological Development Projects in the Food Area during the period 1980-1983.

2. BACKGROUND

2.1 The food security system

The food security system established by Decision 182 of the Board of the Cartagena Agreement in July 1983 is defined as the combination of actions permitting the protection of member States against risks of food shortages and enabling them to satisfy the food and nutritional requirements of the population by improvements in production, productivity, technology, establishment of reserves, marketing and food consumption. (1)

The decision envisages the structuring of national food security systems which will have two main elements, namely: a national food plan and a scheme for institutional organization to provide support for its implementation. (2)

The JUNAC documents define the principal functions of the food plan as combining the effect of policies determining the overall availability of foods with a set of measures whose main intention is to ensure that the purchasing power of all socio-economic strata is sufficient to achieve socially acceptable nutritional levels. (2) This plan proposes a link between the supply and demand for food, a feature which is markedly different from so-called food strategies, which usually only promote agricultural development as a function of aggregated growth rates. (2)

Although the food plan should cover all socio-economic strata of the Andean population in its supply aims, it was necessary, for various reasons, particularly availability of resources, to define priorities with regard to the principal target population groups on the demand side. Consequently, the target population was defined in the first instance as the one with the highest risk of malnutrition. This population group, according to calculations made for 1982 by the Board of the Cartagena Agreement, represents 47.5 per cent of the Andean population. (2)

The Andean food security system emerges in the countries as a response to a situation in which there is a high risk of malnutrition among a large proportion of the population and increasing dependence on external sources of food. In the Andean subregion, food imports increased from 2.9 million tons in 1970 to 8.8 million tons in 1980, resulting from the need to compensate for the imbalance between inadequate local production and growing food demand. Import pressure has been greatest in milk products, meat products, vegetable oils and cereals, which reached a level equivalent to 60 per cent of total food imports in 1980. In the period 1970-1980, imports of oils and milk doubled, while maize increased sixfold and dependence levels of 88 per cent for wheat and 83 per cent for soya were reached. (3)

With regard to the Andean population and the circumstances justifying the existence of a food security plan, the following information can be given:

- In the subregion there is some degree of malnutrition among not less than 40 per cent of the child population, the causes being associated with the low purchasing power of low-income families, an unhealthy environment, illiteracy and difficulty of access to markets;

- The problem of low purchasing power amongst the Andean population is made more acute as a result of the irregular distribution of income: 60 per cent of the population receive between 23 and 26 per cent of the gross domestic product while 20 per cent receive 54 to 73 per cent. The ratio of the high to the low per capita product ranges from 7:1 to 10:1. (4 and 5)

The difficulty of access to markets prevailing among low-income groups results in higher food costs to those groups, in which 50 to 63 per cent of family expenditure goes on food. 1/ (6)

In the last decade, research and development institutions in the subregion have endeavoured to find solutions to the food problem among low-income population

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1/ In the centrally planned European economy countries (Poland, Hungary, Czechoslovakia) the proportion of income spent on food in 1969 ranged from 31 to 40 per cent. (7)

groups at both national and subregional levels. Particular mention should be made at this point of the action undertaken within the Andean Technical Development Projects in the food area, PADT-Alimentos. The technological options proposed as a result of these activities have been analysed in the context of designing production and consumption systems. This analysis has revealed advantages for the consumer, the agro-industrial sector and for the achievement of development targets. Use of these options can make a significant contribution to the food security system.

2.2 The agro-food industry in the context of food security

Research carried out by UNIDO into the role assigned to industry in food security or national food self-sufficiency programmes shows that it has not so far been allocated a specific role in developing countries with market economies. Decision 182 on the food security system in the Andean Pact envisages agro-food industries as a link between agricultural and industrial production and it is proposed to encourage the establishment of agro-food industries according to the nutritional requirements of the population (paragraph 6 (c) of Decision 182). (1)

It is planned to promote industrial development with emphasis on the supply of staple foods as one of the main specific objectives to be achieved within the agricultural and industrial strategies for reorienting Andean integration. (8) These strategies envisage agro-industry as one of the priority sectors in which a policy of incorporating new industrial processes and industrial expansion will be applied in order to satisfy the basic consumption requirements of the population and achieve import substitution in final products and inputs. This strategy further recognizes that the agro-food industry has the capacity to stabilize demand for agricultural products. (8)

Recently, it has been suggested in the draft additional protocol to the Cartagena Agreement that consideration should be given to setting up multinational Andean agro-industrial enterprises to encourage the linking of subregional with foreign capital in specific projects. (8)

The foregoing shows that there is a clear vision within the Andean Pact of the important role that the agro-food industry can play in encouraging agricultural production in the context of Andean integration and in satisfying the basic needs of the population. The countries have already identified priority foods in the food security system, and programmes and projects to stimulate their production are being developed. However, priority processing subsystems for the system have not yet been identified in the industrial sector. It is thought necessary to ascertain demand for processed foods in the system in order then to identify priority processing subsystems and to select the most appropriate technological options. The Board is aware of the need to establish this reference framework in order to programme the development of the industrial component of the food security system before initiating activities to promote the establishment of new agro-food industries in this context.

3. THE ANDEAN AGRO-FOOD INDUSTRY (9, 10)

In the economy of the subregion as a whole in 1980, this branch of industry represented 5.7 per cent of the total gross domestic product and 31 per cent of the GDP generated by the manufacturing sector. It showed an average growth of 5.3 per cent per year while that of the manufacturing sector was 6 per cent. Its growth was greater than that for the manufacturing sector as a whole in four countries (8.5 per cent in Ecuador and about 7 per cent in Colombia, Bolivia and Venezuela) and was very low in Peru (0.1 per cent). (9)

Agro-industry is the most important manufacturing branch in the Andean Pact area from the point of view of gross value of production. In terms of value added, it represented 35 per cent of the total for manufacturing industry in 1981. 2/

For subregional consumers, the food industry is important because 57 per cent of their calories and 73 per cent of their proteins come from foods which have undergone some degree of industrial processing. Prominent among these foods are cereals, oils, milk products and sugar (figure 1). (9)

Analysed from the point of view of a food security scheme, the agro-food industry shows the following features:

(a) A high and growing dependence on the external sector for staple foods, as shown in the previous section. The lack of a linkage between the agro-food industry and the agricultural sector becomes clear when the growth in GDP of both sectors in the period 1970-1977 is compared; 7 per cent in subregional agro-industry and 3.6 per cent in the agricultural sector. (11) The use of a high proportion of imported raw materials and the high degree of urban concentration have been identified as being among the principal factors in the isolation of industry from agricultural production zones, thus further restricting development possibilities for the latter. (8)

(b) High idle capacity resulting in low industrial efficiency, high production costs and low external competitiveness in items such as milk products (capacity for 90,000 tons of powdered milk and 5.5 million litres per day of pasteurized milk), milling of wheat-flour, 1 million tons per year (35 per cent) and pre-cooked cereals, around 100,000 tons. In one country alone records show 75 per cent of underutilized capacity in fish canning and 80 per cent in frozen fish. (12)

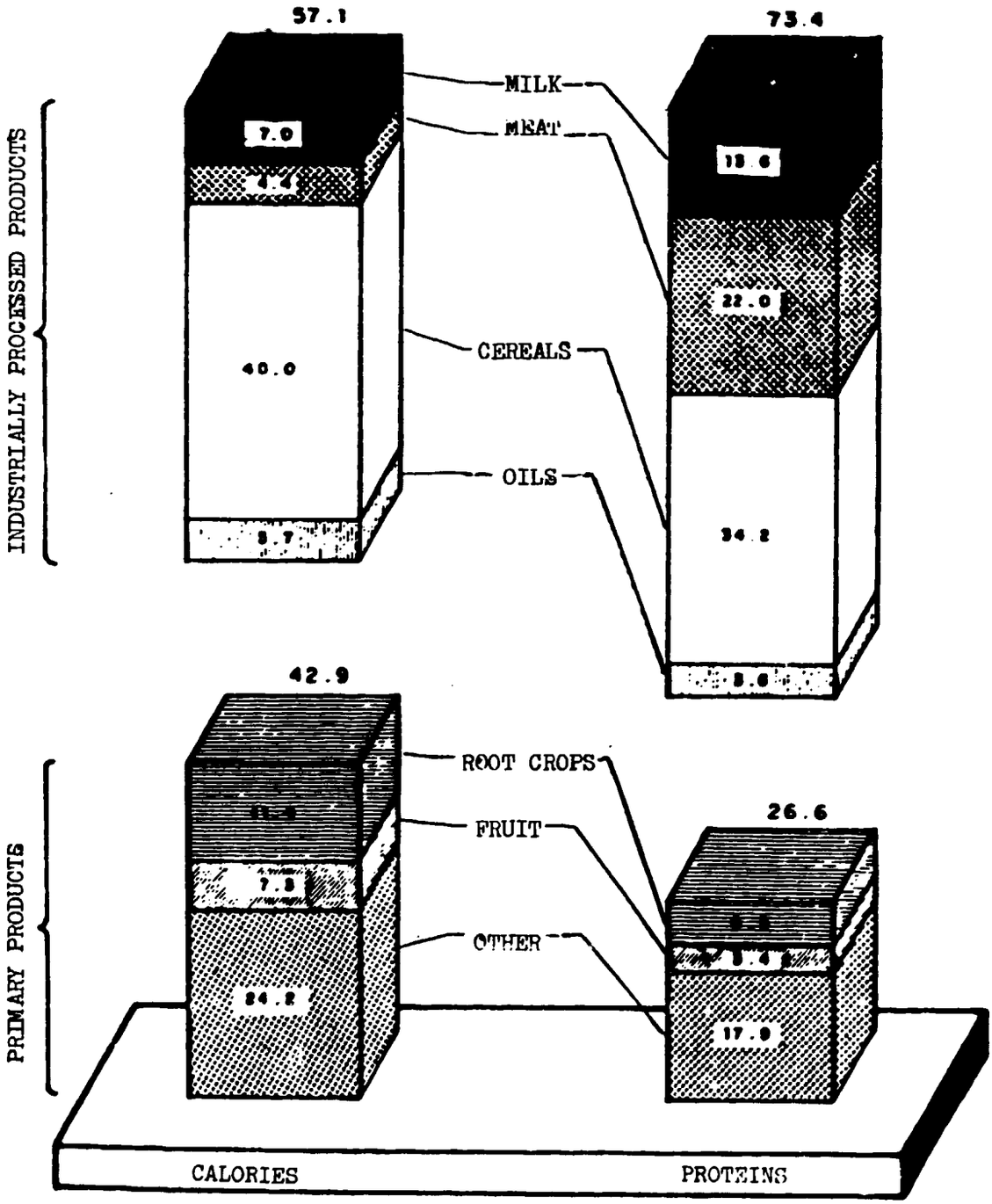
(c) The expansion of demand for conventional processed foods among low socio-economic groups (40-50 per cent of the population) has been very limited owing to the high concentration of income and related income inelasticity (in a country such as Colombia, 52 per cent of the food consumed by the lowest income groups, in both rural and urban areas, was of industrial origin, representing 72 per cent of food expenditure). (13)

(d) Low nutritional cost-efficiency in foods available in the market; of 24 products available for children in 3 countries, only 6, which were also protein sources, provided 100 calories at prices less than $0.10. (4)

(e) The low contribution by the food industry subsector to the child population most at risk to malnutrition. The child population aged between 6 months and 5 years (a priority target population of a food security programme) reached 10.9 million in 4 of the 5 countries (Colombia, Ecuador, Peru and Venezuela). If the industry had aimed at covering 20 per cent of the calorie and protein requirements of those children with relatively low-cost foods mainly based on grains and cereals, it would have had to produce 124,000 tons in that year (1980). The industry produced 60,000 tons, with a high concentration in Venezuela (70 per cent). (12)

2/ This relative importance of the food industry in the Andean Group is comparable with the importance of the same industry in countries of the European Economic Community, where it occupies first place in terms of value added and gross production, followed by the mechanical and electrical engineering and metal manufacturing industries, footwear and clothing. It also occupies first place individually in countries such as Belgium, Denmark, Ireland, the Netherlands and the United Kingdom. (10)

Figure 1. Sources of calories and proteins in the subregion (1980)



Source: JUNAC, El sector de alimentos infantiles en la subregión andina, Technology Policy Group, PADT-Alimentos, Lima, 1983.

(f) There is no systems concept in the promotion of the food industry. Decision criteria in this industry concentrate on individual projects; this approach is shared by entrepreneurs and the State, which reinforces the lack of interlinkage between the primary and food industry sectors as a significant option in promoting development. (12)

(g) The low level of co-ordination between the large number of institutions involved in agro-food industrial development at country and subregional level. There is a vacuum in the marketing services for agricultural raw materials and limited organization of producers by product and by region, which has a negative impact on the interrelation between the agricultural and industrial sectors. (8)

(h) There is an adequate technological research infrastructure for the agro-food industry in most of the Andean countries, a pool of knowledge developed at national and subregional level; but, in general, technological development action has little impact on subregional food problems. (8, 13)

4. THE POTENTIAL CONTRIBUTION OF THE AGRO-FOOD INDUSTRY TO THE FOOD SECURITY SYSTEM

4.1 Preliminary considerations

It is considered appropriate at this point to include a few notes on the criteria and conditions which food-processing agro-industries should take into account in order to operate within the food security scheme.

Foods must be relatively low-cost products. In countries such as Colombia it has been said that the lack of food security is due to the fact that low-income groups spend a high proportion of their income on food, yet consume less calories than they need. For these groups, insufficient food production can imply a considerable increase in the price of food and thus a reduction in real family income or expenditure. As a result, there will be a drop in food consumption and further deterioration. (14) This proposition, which is probably applicable in varying degrees to other Andean countries, suggests that fresh or processed foods must have a relatively low cost and high nutritional cost-efficiency.

Industrialization can offer advantages in the formulation of foods with high nutritional cost-efficiency and also economic advantages in their utilization within the home. 3/

Figure 2 shows the cost structure for two children's foods, one of them industrially processed and the other prepared at home from unprocessed ("traditional") raw materials. It may be observed that more than 50 per cent of the "effective cost" 4/ of preparation is represented by home preparation costs and that the effective cost of industrially processed food is 20 per cent lower than that of food prepared in the home.

Figure 3 compares the effective cost structure of two processed foods which provide similar amounts of energy and protein. It can be observed that the effective cost of product 2 is 2.5 times higher than that of product 1. In other words, the advantages of the pre-cooked cereal offered by product 2 do not

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3/ Measured in terms of: savings of time, fuel (very important in marginal urban and rural areas), less frequent purchase intervals, increased nutrient concentration, reduction of wastage (during marketing and in the home).

4/ Effective cost includes those additional costs of home preparation (time, water, fuel), spillages and waste, as well as the costs of raw materials.

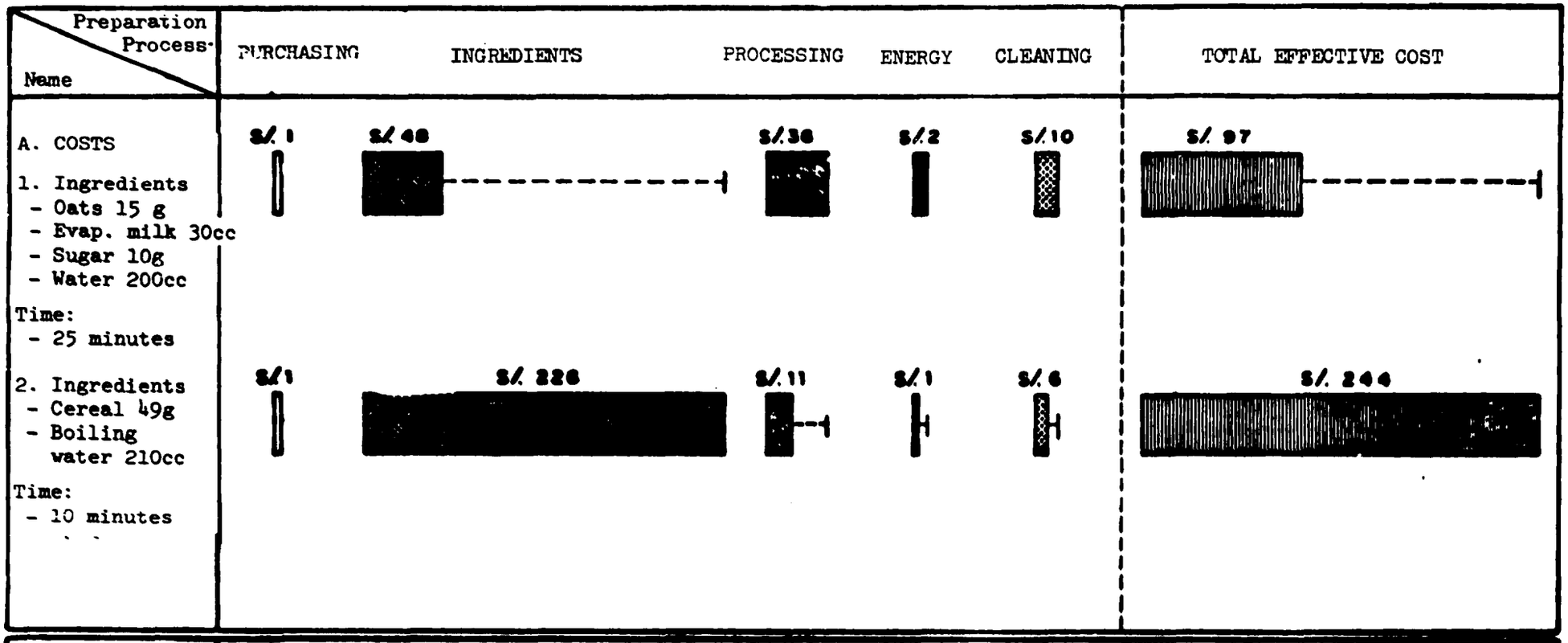
Figure 2. Cost structure of two products for children: Peru

I. PROCESS MODEL	ACQUISITION	INGREDIENTS	PROCESSING	ENERGY	CLEANING	CONSERVATION	TOTAL
Factors involved in the preparation process	Time taken Cost of transport	Value of quantity of products utilized Value of water	Value of labour in following tasks: - Cleaning ingredients - Preparation of ingredients - Processing - Cooking	Fuel Equipment	Value of labour Water and detergent	Cost of products purchased but not used due to: Wastage and shrinkage - Refrigeration - Packaging	
II. EXAMPLES A. Cost of preparation 1. Traditional wheat porridge	1.4 %	27.5 %	56.3 %	1.9 %	11.5 %	1.4 %	S/. 117.8
2. Processed oats with milk	0.5 %	49.7 %	37.4 %	1.6 %	10.8 %		S/. 96.7

B. Nutritional cost-efficiency	ENERGY (100 cals.)	PROTEIN (10 gm.)	CALCIUM (mg.)	IRON (mg.)	VITAMIN A (u.i.)	B2 (mg.)	NUTRITIONAL CONTENT OF THE RATION Calories	Proteins (g)
1. Traditional	S/. 81.3	S/. 143.7	S/. 5.5	S/. 94.6	S/. 0.91	S/. 1,455	143	8.1
2. Processed	S/. 39.8	S/. 179.0	S/. 0.8	S/. 131.4	S/. 0.53	S/. 197	224	9.4

Source: JUNAC, El sector de alimentos infantiles en la subregión andina, Technology Policy Group, PADT-Alimentos, Lima, 1983.

Figure 3. Comparison of preparation costs of two manufactured children's foods; Peru (S/. May 1982)



B. NUTRITIONAL EFFICIENCY	WEIGHT OF RATION (g)	NUTRITIONAL CONTENT OF RATION		EFFECTIVE COST PER NUTRIENT	
		Calories	Protein (g)	100 calories	10 g protein
1.	287	224	8.4	S/. 43.7	S/. 170.6
2.	259	208	5.4	S/. 117.3	S/. 451.8

Source: JUNAC, El sector de alimentos infantiles en la subregión andina, Technology Policy Group, PADT-Alimentos, Lima, 1983.

compensate for the higher effective cost of the product. This shows the need for careful selection of technological options in industrialization in order to maintain a high nutritional cost-efficiency in the processed product. (4)

By appropriate formulation of processed foods it is possible to correct protein-energy imbalances in diet and situations which might arise in applying the strategy (for food supplements) of supplying more of the foods usually consumed by the low-income part of the population. 5/

Figure 4 taken from Ochoa (15) illustrates the previous point. The vertical axis B represents "fullness" or "satiety" and the horizontal axis I represents income (involving quality and variety of foods and possibilities for substituting one food for another). The line SS' is the saturation line, above which there are constraints with regard to the maximum volume of foods which the recipient is physiologically capable of absorbing in a given ration.

The curves PR and CR represent protein and calorie requirements, and the curve ABCDS' is the hypothetical food consumption curve for rising levels of income 1, 2, 5, 6 and 7.

From this graph, it is possible to deduce that:

- The income interval between the point where calorie requirements and protein requirements are satisfied can be large.

- To improve the diet solely by increasing the quantity, but not the quality, of the normal food to a point such as M in order to satisfy both energy and protein requirements would be impossible since point M is well above the saturation line SS' (physiological capacity). (15)

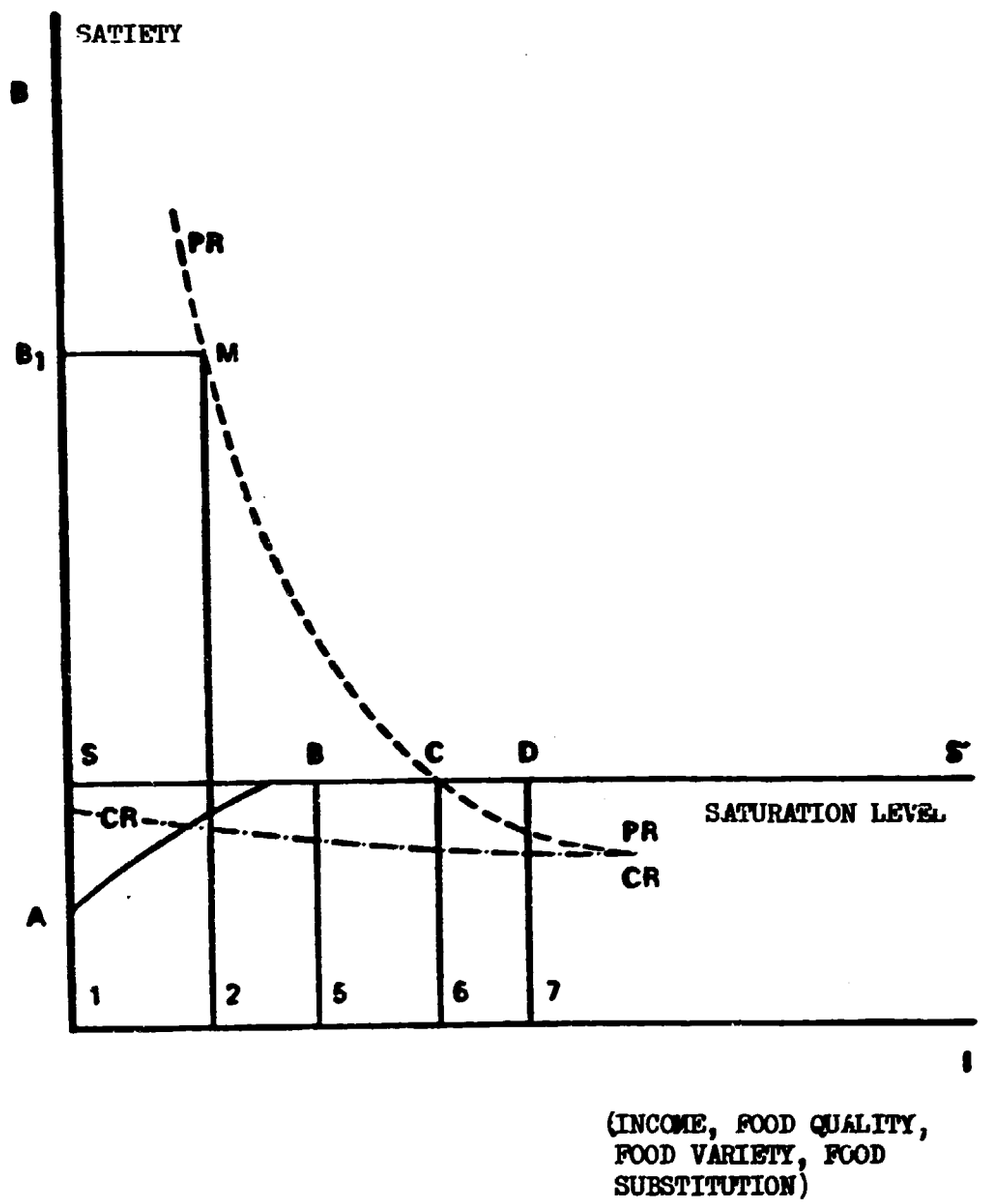
To summarize, the use of processed foods which give an adequate protein/energy balance, based on the habits of the population and a cost-efficient nutritional concept and whose cost is lower than conventional foods offers the possibility of improving both the diet of low-income groups and the variety and quality of food supplement programmes. (16)

The foods must cover a high proportion of the target population distributed in rural and urban areas. The target population of the food security programme was initially estimated at 47 per cent of the total population of the subregion. (2) It was estimated at 40 per cent for Colombia, corresponding to income groups I-IV in the rural sector and group I in the urban sector. (14) In Bolivia, the concentration of the target population classified as most deprived is greater both in rural areas and in towns and is equivalent to 55 per cent of the total population. (17) Within these groups, the food security system can certainly be directed initially and in the short term to mothers and children, the section of the population most vulnerable to malnutrition, and secondly to schoolchildren and the marginal adult urban or rural population. 6/ This theme will be fully analysed in this workshop during the discussion of a methodological approach to determine demand in a food security system.

5/ To correct the protein-energy nutritional gap.

6/ The target population for food supplement programmes in the subregion amounts to 8.5 million mothers and children. With regard to the school population within programmes being implemented in 1982 and proposed for 1983 it was hoped to cover a total of 3,172,000 children (in three countries) with rations in the form of school snacks, breakfasts and lunches for periods varying between 155 and 180 days per year.

Figure 4. Relationship between satiety, nutritional requirements and income levels



Source: Convenio Hipólito Unanue, JUNAC, Pan American Health Organization, Análisis comparativo de los programas de complementación alimentaria al grupo materno infantil en la subregión andina, in "Memorias del primer seminario taller sobre programas de complementación alimentaria del grupo materno infantil de la subregión andina, Bogotá, Colombia, 1-5 December 1980", published by JUNAC, PADT-Alimentos (1981), pp. 170-172.

Food production must promote the use of idle installed industrial capacity. The figures on idle industrial capacity in the food sector, taken in conjunction with those for the target population of food supplement programmes show an interesting potential for intervention by local industry, whether in the activities of the primary or secondary industrialization sectors, by improving the utilization of installed capacity, industrial efficiency, production costs and competitiveness at national and possibly subregional level.

Where plant rehabilitation and the installation of additional production lines is concerned, the application of the disaggregation concept can lead to significant savings in investment and raise the level of integration. In a pre-cooked maize flour plant in Colombia the disaggregation of a turnkey project resulted in the attainment of a 70 per cent integration level and a reduction of some 34 per cent in investment. The plant became operational within the time originally planned in the turnkey project and currently plays an important role in the pre-cooked maize flour market in that country. 7/

Food production must promote the utilization of locally produced raw materials. Options leading to a greater reduction of food dependence will be of interest in two senses:

- In relation to the import of prepared foods or food raw materials to be processed by national industry, and

- In reducing the form of food dependence which is based on international food donor programmes, which not only have high internal distribution costs but also lead to patterns of consumption which are inconsistent with local diet patterns. (16)

Entrepreneurial strategies should favour the production of relatively low-cost foods for the low-income market. Figures 5 and 6 describe the composition of costs and gross value of production for two enterprises operating in a country within the subregion. 8/ (4) Both produce pre-cooked cereal of equivalent quality. The price ratio is 1:4.5 and the volume of sales 2.3:1. The national enterprise C directs its production to the low- and medium-income market, has a high volume of output and minimizes costs, covering urban and rural markets. The foreign enterprise D aims at the medium- and high-income market, and has high financial costs for advertising, sales and management. 9/ It has greater product differentiation, concentrates it sales outlets in the urban sector and sacrifices market share in order not to reduce profit margin. 10/ Production cost is 65 per cent of total cost in enterprise C and 38 per cent in D (figure 5). The breakdown of gross value of production highlights the great capacity of enterprise D to generate value added (largely due to the remuneration element) and the closer links between enterprise C and the national farming and industrial sectors.

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7/ Technological Research Institute, Bogotá, Colombia, direct communication, November 1985.

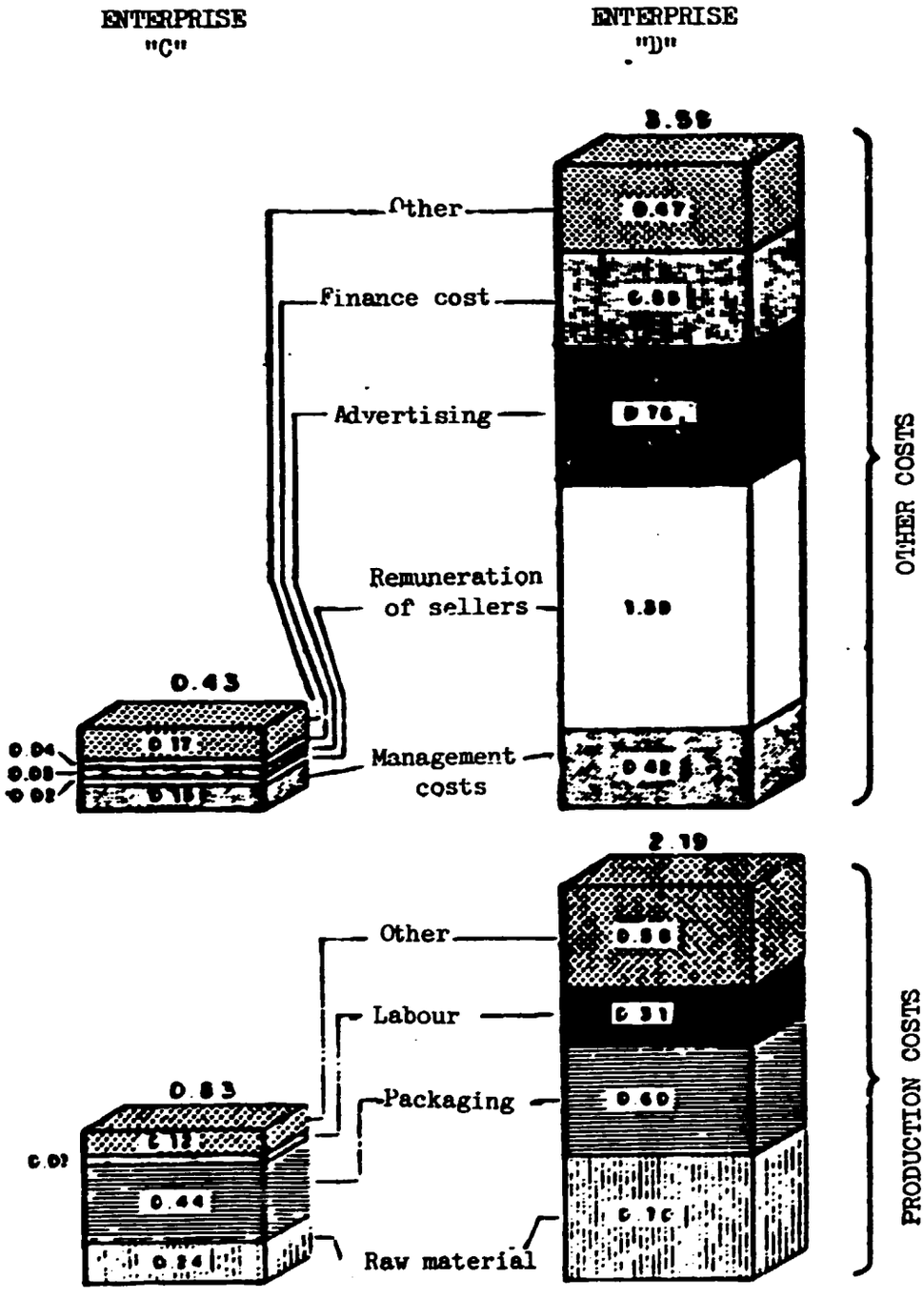
8/ 1980 data.

9/ A high proportion of which reverts to the parent company.

10/ Between 1977 and 1980 it increased prices by 35 per cent and reduced sales by 45 per cent.

Figure 5. Composition of unit costs for two enterprises producing children's cereals: Venezuela 1980

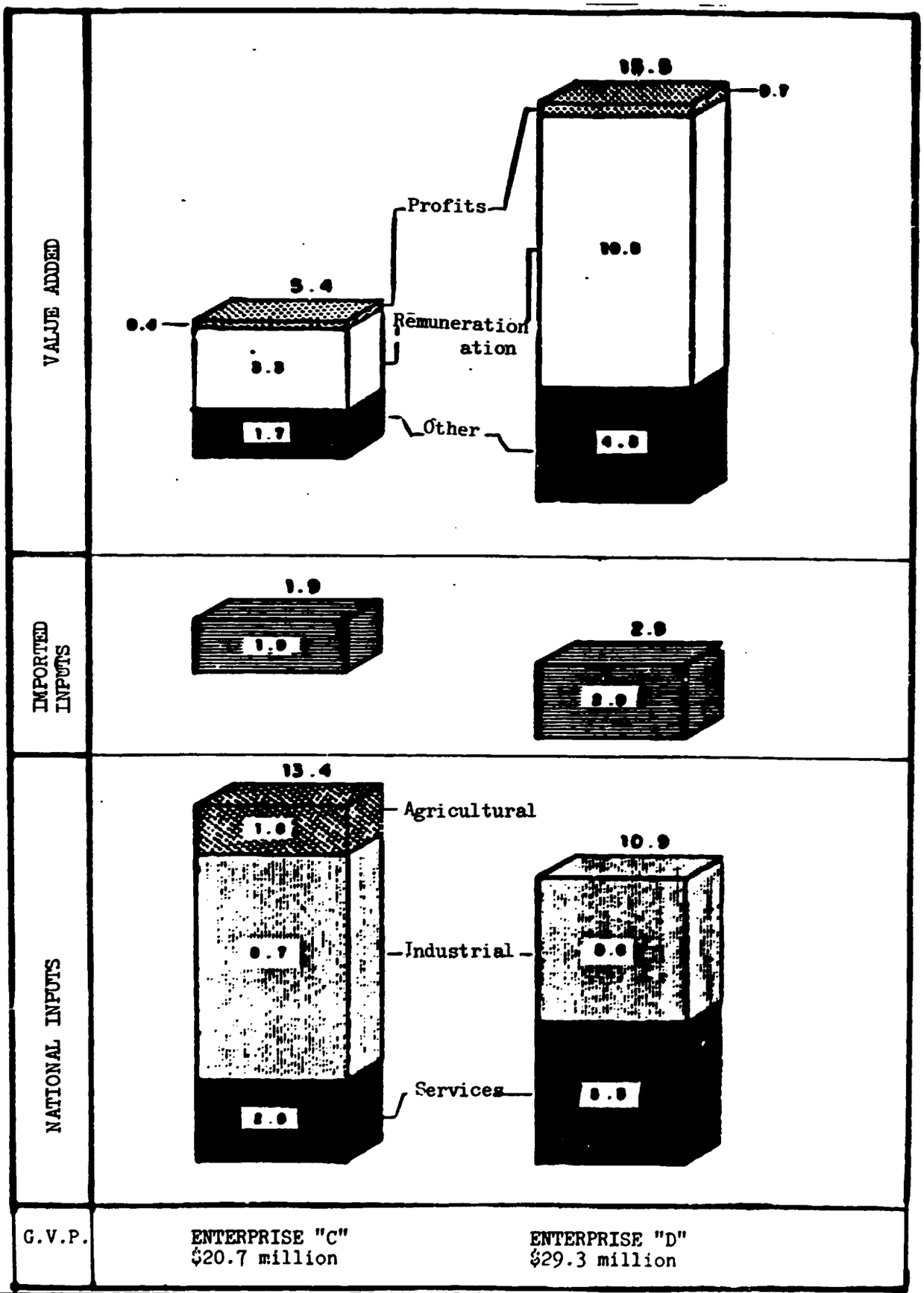
(US$/kg)



ENTERPRISE	"C"	"D"
Unit cost ($/kg)	1.26	5.78
Sales volume (1,000 t)	14.60	4.30
Source of capital	NATIONAL	FOREIGN

Source: JUNAC, El sector de alimentos infantiles en la subregión andina, Technology Policy Group, PADT-Alimentos, Lima, 1983.

Figure 6. Comparison of the gross value of production for two enterprises producing children's cereals, Venezuela, 1980
(US$ million)



Source: JUNAC, El sector de alimentos infantiles en la subregión andina, Technology Policy Group, PADT-Alimentos, Lima, 1983.

Enterprise C utilizes $1.04 of economic resources to sell one kilogram of food while the corresponding figure for enterprise D is $2.20. It could be said that enterprise C is more efficient in its utilization of the country's resources. (4) By analysing the operation of the two enterprises in terms of industrial development subsystems, it would be possible to measure the backward linkages of both and their effectiveness in a food security system. At present the enterprise C strategy would appear to be of greater interest and relevance to the food security system owing to its level of production, type of coverage and prices.

4.2 Industrial subsystems and technological options

A classification of primary and secondary processing in the agro-food industry is described in annex 1. According to this classification it might be thought that the industrial activities of greatest interest for the agro-food industry within a food security programme would mostly be those in the primary processing group, excluding fruit and vegetables, cider and wines. Within the secondary processing group, the manufacture of flour and bread, spaghetti and macaroni would in particular be very important. 11/

Although the subject of selecting industrial subsystems and technological options will be considered separately in the current workshop, it is considered to be appropriate to present some of the technological options recently analysed at subregional level which are applicable to the following sectors: milk products, wheat milling, bread and pastas and rations for school food supplement programmes.

Bearing in mind the relative importance of the informal production sector in Andean countries there will be a brief preliminary discussion of the sector providing ready cooked food (street food vendors). This involves the need to analyse its role within the food security system in the marginal urban sector and to study the possibilities for encouraging its integration with the formal sector as well as for promoting it at a formal level through controlled assistance and credit.

4.3 Milk products sector

One technological option analysed in the Andean countries was the production of milk extenders, which are foods with functional and nutritional features similar to those of milk, with a high degree of replacement of milk (70 per cent) by local raw materials (rice or maize flour and soya meal). Extenders are produced by the enzymatic hydrolysis of cereals, utilizing idle capacity in pasteurizing, sterilizing and powdered milk plants. The final products are cheaper than milk.

These foods have been produced on an experimental industrial scale in all the countries and on a commercial basis in Bolivia. There was a high level of acceptance of the foods among the school population and mothers and children in all the countries. 12/ (18)

Table 1 illustrates the role that these foods could play in food supplement programmes in three of the five Andean countries.

- The use of idle industrial installed capacity to produce extenders could considerably raise capacity utilization, as shown in table 1. (18)

11/ Primary: milk products, meat and meat products, sugar, oils and fats, milled grain and conserved fish. Secondary: flour and bread, cocoa, chocolate and confectionery, spaghetti and macaroni.

12/ In three-month trials with schoolchildren and open-market trials in Bolivia. (18)

Table 1. The role of milk extenders in food programmes in three countries in the Andean subregion

Extenders	Type of product	Rations/year (in millions)	Capacity utilized a/	Capacity required a/	Surplus (+) or deficit (-)
School breakfasts					
Ecuador	Pasteurized liquid extender	178.5	13	71	16 (+)
Bolivia	(a) Pasteurized liquid extender	55.8	17	20	63 (+)
	(b) Powdered extender	53.1	20	19	61 (+)
Peru	Pasteurized liquid extender	430.0	Milk pasteurizing plants with packaging systems for 250 cm^3 containers		
Mother-and-child programme					
Bolivia	(a) Pasteurized liquid extender	60.0	17	15	58 (+)
	(b) Powdered extender	242.0	20	87	7 (-)

a/ Percentage of installed capacity.

Source: JUNAC, Los extensores del consumo de leche en el marco de los PADT-Alimentos, "Una experiencia de transferencia de tecnología", Technology Policy Group, PADT-Alimentos, Lima, Peru, 1983.

Table 2. Comparison of costs of milk extender in relation to milk in five Andean countries

Description	Cost of extender compared to cost of milk Extender a/ Alternative 1	 Extender b/ Alternative 2
Bolivia: (pasteurized liquid product)		
- Vanilla flavour	65.7	75.2
Colombia: (sterilized liquid product)		
- With chocolate	70.4	77.1
- Vanilla flavour	67.2	74.6
Ecuador: (pasteurized liquid product)		
- Prepared with subsidized powdered whole milk		
- With chocolate	95.1	103.0
- Vanilla flavour	94.5	103.4
- Prepared with powdered milk at international market price		
- With chocolate	75.6	85.0
- Vanilla flavour	73.5	83.6
Peru: (pasteurized liquid product)		
- Vanilla flavour	75.0	82.8
Bolivia: (powdered product) c/		
- From powdered whole milk		
- With chocolate	78.8	-
- With dulce de leche (milk caramel) flavour	76.6	-
- From powdered skimmed milk		
- With chocolate	90.0	-
- With dulce de leche (milk caramel) flavour	87.6	-

a/ 12 per cent solids in final product.

b/ 15 per cent solids in final product.

c/ In comparing powdered products, the following have been taken into account:

- Cost of raw material for powdered whole milk: $157 and for powdered skimmed milk: $124.

- Final cost of powdered whole milk: $240 and powdered skimmed milk: $210.

Source: JUNAC, Los extensores del consumo de leche en el marco de los PADT-Alimentos, "Una experiencia de transferencia de tecnología", Technology Policy Group, PADT-Alimentos, Lima, Peru, 1983.

- Production costs for extenders 13/ are 15 to 25 per cent lower than the local cost of milk in every case, as shown in table 2.

An evaluation of the comparative advantages of producing milk extenders for a food supplement programme for mothers and infants in Bolivia was carried out in 1982 by comparison with the current system of powdered milk production. 14/ Some of the results of the evaluation are included in table 3, which shows the effects of the two systems on the Bolivian economy in the fifth year of the programme. 15/

Table 3. Effects of the production of milk extender on the economy compared with the current powdered milk production system a/

1.	Nutrient cost	(kg/cal)	-41.66 per cent	
2.	Natural resources	(ha)	-41.5 per cent	(- 19,000 ha)
3.	Foreign exchange requirements	($US)	-21.3 per cent	(- 549,000 $US)
4.	Additional gross investment	($US)	-65.7 per cent	(- 3,061,000 $US)
5.	Additional financing	($US)	- 6.1 per cent	(- 805,000 $US)
6.	Government account	($US)	Positive effect	22,329,000 $US
7.	Returns	($US)	Reduced loss	26,844,000 $US
8.	Value added	($US)	+ 20 per cent	4,490,000 $US

a/ An example in Bolivia, Cochabamba zone, mother-and-child programme with replacement of 70 per cent of powdered milk by raw materials produced locally, viz. maize and soya flours and vegetable oil. (12)

- Owing to its lower cost per calorie (42 per cent less), the extender can be classified as a relatively low-cost food. The foreign exchange requirement falls by some 21 per cent.

- The additional gross investment is 66 per cent lower.

- The additional financing is 6 per cent less and plant utilization capacity rises from 42 to 100 per cent.

- With regard to government accounts, there would be a positive effect of $22 million, which could be used for agricultural or industrial development or for selective subsidies to increase demand for the product amongst the lowest income groups.

- The extender system generates profits greater than $26 million.

- The value added is some 20 per cent higher.

- The system using extenders reduces the requirement for natural resources by 19,000 hectares in a zone where the livestock production system has reached its capacity limit. (12)

13/ Obtained directly during plant operation.

14/ Using the methodology "Evaluation and programming of production and consumption systems". (19)

15/ Measured by micro- and macro-economic indicators.

An evaluation exercise on the potential role of milk extenders to cover the projected milk production deficit at subregional level (estimated at 1.5 million tons for 1985) showed that 131,000 tons of maize or rice flour, 698,000 tons of powdered milk, 28,000 tons of soya meal and 23,000 tons of vegetable oil would be required. The backward linkage of and articulation with the subregional agricultural sector resulting from the application of this technological option could doubtless be significant. (18)

4.4 The wheat milling, bread and pastas sector

Composite flours have for a number of years been proposed as a technological and economic option in view of industrial growth problems related to wheat and its derivatives. These problems lie in the progressive decline, from 1960 until the present day, of raw material production, areas under cultivation and yields per hectare; the existence of high idle installed capacity in agro-industry at subregional level; the oligopolistic nature of the supply of flour in some of the countries and the marked increase in per capita consumption of wheat flour in the last 10 years. All these phenomena have been accompanied by an increase in the rate of dependence on external supplies of wheat (90 per cent of consumption) and a foreign exchange expenditure exceeding $700 million annually.

A great deal of technological and economic work done at subregional level has indicated practical solutions regarding partial substitutes for imported wheat at industrial level and extensive trials among flour mills, bakers and in the open market show acceptance by the industry and the consumers. 16/ Analysis of the results obtained up to 1980 showed that a solution had been found regarding the technological component in the subregion and that, in order to put it into practice, it was necessary to harmonize policies for production and consumption of wheat and composite flours and to prepare national proposals for programming the corresponding production and consumption systems in the five countries. These proposals were further refined between 1982 and 1983 by national teams in the five countries, applying the methodology for the evaluation, programming and management of production and consumption systems. The proposals specify in detail not only the investment projects required for the various components of the system 17/ but also the policies that must be implemented in order to achieve optimum performance of the components and the system. 18/ (20)

The implementation of these programming proposals (over 5 years in four of the countries and 10 years in Peru) would require agriculture to provide the following quantities of the main products to replace imported wheat in the fifth year of the programme.

Products	Year 1	Year 5	Countries
Rice	340,000	910,000	Venezuela and Colombia
Maize	56,300	97,200	Ecuador and Bolivia
Soya	30,880	38,870	Bolivia and Colombia
Home-grown wheat	122,600	178,000	Peru and Bolivia

16/ The maximum substitution levels are 70 per cent for food pastas and 30 per cent for bread from precooked and uncooked maize flour, uncooked rice and barley flour and flour from home-grown wheat. (20)

17/ Agricultural, agro-industrial, consumption.

18/ Production, prices and subsidies, taxation, marketing, investment, credit, technologies and co-ordination.

Table 4 shows the main economic indicators for the systems proposed in each country and a comparison, with the results which would be obtained if the current scheme were to be continued. The advantages of the compound flour system would be as follows:

- The cost of compound flour would be reduced by 4, 6 and 5 per cent in Colombia, Equador and Peru and 18 per cent in Bolivia. There would be a cost increase in Venezuela.

- The nutritional level for the systems proposed in each country would be as favourable as or very similar to the alternative of using imported wheat flour.

Table 4. Composite flours in the Andean subregion - comparison of the principal indicators for the proposed and current systems at year 5 of the programme a/

Variable	Current scheme	Proposed scheme
Price of flour ($/t)	307-538	323-539
Protein cost ($/t)	3,350-4,371	3,365-3,596
Calories per $	10,353-7,140	11,339-7,690
Wheat imports ($)	708,670	570,032
Total foreign exchange requirement ($)	712,106	611,119
Natural resources (hectares under cultivation)	112,440	821,813
Value added ($1,000)	200,370	310,431
Employment	16,747	76,793
Government account	213,179	207,453
Investment required ($1,000)	14,593	82,724

a/ With the exception of investment, all the variables correspond to year 5 of the programme.

Source: JUNAC, La producción de harinas compuestas como componente de una política triguera en la subregión andina, Volume I, Technology Policy Group, PADT-Alimentos, Lima, Perú, 1983.

- There would be savings of $140 million in year 5 in terms of wheat. If demand for flour, and international wheat prices, remained constant over the five years under consideration, the cumulative savings in foreign

exchange during this period and for the subregion would be in the region of 700 million constant dollars. 19/

The additional net requirement for land in the systems proposed would be more than 271,000 hectares at subregional level; in Colombia and Venezuela these areas would be used for the cultivation of rice, whose main market is whole polished rice, broken polished rice being the by-product used in composite flours.

- With regard to the value added indicator, the systems proposed in each of the countries give better results than the corresponding current systems, the value added in the fifth year being $110 million greater. The generation of greater value added, principally in the agricultural sector, will produce a multiplier effect throughout the economy.

- In all the systems proposed the utilization of labour would be significantly greater than in the corresponding current systems and, taking the subregion as a whole, employment would be more than four times as much as in the current system. 20/ (20)

4.5 The industry and food supplement programmes for schoolchildren

Food supplement programmes supply daily food rations which provide part of the nutritional requirements of school-age children.

Programmes of this type carried out in 1983 in Colombia, Peru and Venezuela reached a total of some 2,480,000 schoolchildren, which entails the handling of some 55,000 tons of food annually by the State organizations responsible for implementing the programmes.

These programmes are implemented in the countries by agencies that do not specialize in food handling and services, with very little involvement of industry.

Owing to the complexity of the programmes, the number of variables which affect their implementation and the number and variety of activities to be carried out, the targets selected and programmed from a nutritional, economic and administrative point of view cannot be met efficiently.

Pilot studies on the distribution of rations made up of foods produced by local industry were carried out in Colombia, Peru and Venezuela. (21)

The rations were designed to fulfil the following needs:

- They should consist of foods produced by local industry or whose production technology had been developed by research institutes in the countries and were ready to be implemented;

- Available industrial capacity was to be made use of in the production of these foods;

- The nutritional contribution of the total food ration should as far as possible represent one-third of the daily energy and protein needs of school-children;

19/ The components involved in the production of composite flours require imported inputs; consequently, the foreign exchange savings for each country and the subregion would be reduced. For this reason, at subregional level, the net savings in foreign exchange would be 101 million constant dollars in the fifth year.

20/ In all countries basically, the greater use of labour is accounted for by the agricultural element within the systems proposed.

- The products should be "finished", in other words should keep for ten days without refrigeration or further preparation;

- The ration should have proven acceptability to the school population.

Table 5 compares the cost of the pilot finished ration distribution programme 21/with those of the school lunch programme currently operating at national level in 1982-1983. (21)

Table 5. Comparison of the costs of the "finished" ration distribution programme and the programme currently in operation in Venezuela

Concept	Current programme	Finished rations distribution programme	
		Alternative A	Alternative B
1. Protein content of ration (g)	22.0	23.8 b/	23.8 b/
2. Calorie content of ration (cal)	840.0	595.5 b/	595.5 b/
3. Coverage (Number of beneficiaries)	288,295 c/	60,000.00 d/	60,000.00 d/
4. Product cost ($/ration)	0.467	0.885	0.889
5. Cost per ration served ($)	1.93	1.05	1.10
6. Cost per 1,000 g of protein ($)	87.73	44.10	46.20
7. Cost per thousand calories	2.30	1.76	1.84

A: Distribution using State resources.

B: Distribution under contract.

a/ Lunch in school dining-room.

b/ Average values for the various rations.

c/ At national level.

d/ Only Yaracuy State.

Source: Board of the Cartagena Agreement, "Propuesta para la racionalización de programas de complementación alimentaria a escolares. Uso de raciones", Technology Policy Group, PADT-Alimentos, Lima, Peru, 1983.

21/ Undertaken in collaboration with the industry in Venezuela for a period of three months and with a high level of acceptability to the pupils of a school in Yaracuy State, Venezuela.

As can be seen, the introduction of rations improves the administrative efficiency of the programme, and the ration programme is cheaper than the traditional programme currently in operation although the cost of processed foods is higher (line 4 of table 5).

It is interesting to emphasize that the cost per protein unit, in a programme based on "finished" rations, is between 48 and 50 per cent cheaper than in the current school lunch programme, while the calorie unit is between 20 and 23.5 per cent cheaper.

The micro-economic advantages shown in this table for the ration programme would be reinforced if it were analysed at national level and from a macro-economic point of view, taking into account the possible linkages with the various sectors connected with the system. (21)

4.6 The informal sector

An additional factor to be considered in the context of a food security programme and the role of industry within it relates to the great urban concentration that has grown up in the last 20 years in the Andean countries. 22/

This high urban concentration, together with the economic difficulties faced by the population recently absorbed in the large towns, has led to the creation of a great many industrial activities in the informal sector. 23/ Among these occupations, the preparation and supply of finished foods for street consumption can play an important part.

Studies recently carried out in a number of cities in Africa and Asia (22) show that there can be as many as 18,000 itinerant street food vendors (Bogor, Indonesia) or 5,100 (Iloilo, Philippines), both these cities having a population of 250,000. The annual sales turnover generated by this sector reached $67 million in Bogor and $2 million in Manikganj, a town of 38,000 inhabitants serving a rural area in Bangladesh. Some 25 per cent of the micro-enterprises provide employment and therefore some 6 per cent of the workforce is involved in this activity in Ziguinchor (Senegal) and Manikganj (Bangladesh) and 15 and 25 per cent in Iloilo and Bogor, respectively.

Surveys carried out in Indonesia and the Philippines have shown that families spend approximately 25 per cent of their food budget on street meals, a proportion which is consistent throughout the various income levels. The proportion is close to 20 per cent in Senegal. Although at the outset these foods were not considered to be an integral part of the diet, the study to which we refer (22) shows that they provided oils and fats which were frequently lacking in the home-prepared diet of low-income groups. In the case of Bogor it was ascertained that more than half the requirements of protein, iron and vitamin A could come from a street meal.

22/ According to the World Bank, The World Development Report 1985, the proportion of the population in Andean countries living in urban areas grew as follows between 1965 and 1983:

Bolivia:	26 to 43 per cent	Peru:	52 to 67 per cent
Colombia:	54 to 66 per cent	Venezuela:	72 to 85 per cent
Ecuador:	37 to 46 per cent		

23/ In an Andean country such as Peru, 21 per cent of the economically active population is in the informal urban sector.

At present we do not have corresponding statistics for this informal subsector in the large Andean cities, but we consider that this sector for the production of street meals, which is a feature of many cities in the third world, may be an important component of the Andean food system, for the following reasons:

- Street food vendors in the large third world cities frequently provide an important source of "finished" foods purchased by schoolchildren, labourers and industrial workers.

- This activity generates upstream and downstream linkages and may have important implications for domestic food production and even for the industrial sector supplying intermediate products.

- Appropriate technical assistance for this type of activity may allow a nucleus of street food micro-enterprises to operate more effectively by the establishment of an organized enterprise providing industrially prepared food to workers and schoolchildren, in the framework of an activity that could be more or less of the same kind as "catering". 24/

Therefore, it would seem appropriate to consider the food and nutritional implications of this informal activity within a food security programme and to establish policies to encourage its development.

24/ Case study of a nucleus of food micro-enterprises in Mexico City. Ford Foundation, Mexico, direct communication, October 1985.

ANNEX I

The activities of the food processing industry are classified in various ways. According to one classification, adopted by the European Economic Community, they are divided into primary and secondary processing. The first group includes the manufacture of milk products, meat products and meat conserves, processing and conservation of fruit and vegetables, manufacture and refining of sugar, manufacture of vegetable and animal oils and fats, milling of grain, processing and conservation of fish and other sea products, manufacture of cider and wines, and other beverages, by fermentation. Included in the secondary processing group are: beer, malt, production of flour and bread, manufacture of cocoa and chocolate and confectionery products, manufacture of other food products, distillation of ethyl alcohol. From fermented materials, manufacture of carbonated beverages and mineral water, manufacture of starch and starch products, manufacture of spaghetti, macaroni, etc.

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