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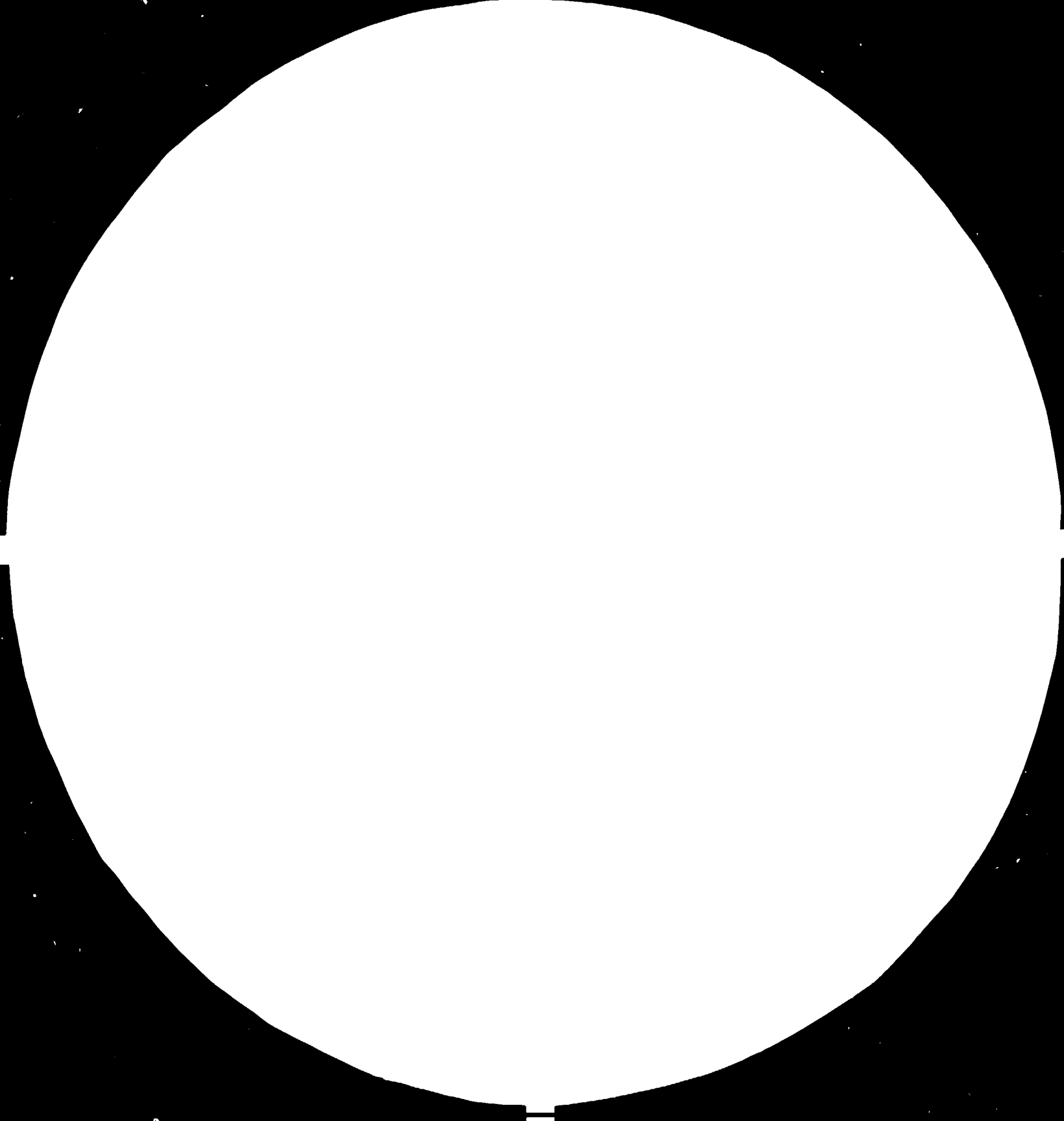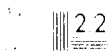
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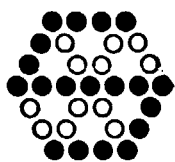
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società per la matematica
e l'economia applicate spa

piazza del collegio romano, 2
00186 roma
tel. 6798443 - 6798487 - 6792474
telex 613459 SOMEA I

13085

Brazil.

COMPARATIVE ANALYSIS OF THE AGRO—INDUSTRIAL DEVELOPMENT PROGRAMME

AND ITS IMPLICATIONS FOR BRAZIL .

EXECUTIVE SUMMARY .

Final Report

June 1983

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I N D E X

I. INTRODUCTION

The study "Comparative Analysis of the Agro-Industrial Development Programme and its Implications for Brazil" has been conceived as an instrument to assist the Brazilian Government policy making staff in the field of agro-industry/food processing development.

The basic objectives of the study can be briefly described as:
. to formulate a methodology to study the basic elements of food processing development and its relationships with econo-mic growth in a systematic way through a comparative analysis regarding a sample of countries including Argentina, Australia, France, Italy, Spain, Sweden, the United States and Yugoslavia and to analyze the basic characteristics of a specific group of food products;

. to elaborate specific recommendations concerning food processing development to be used in policy formulation for Brazilian agro-industry development.
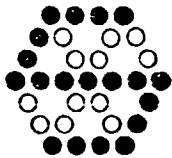
In order to attain the above mentioned objectives the study has been articulated in two main parts the first part consists of the establishment of a wide data base for the definition of comprehensive information systems regarding the main aspects of agro-food processing development in the countries concerned. The second part regards the analysis, on the basis of a methodological framework previously defined, of the "figures" provided by the above-mentioned information systems. This part of the analysis has also covered the comparison of the main policies being applied in the different countries to hasten agro-food processing development.

The combined analysis of the structural characteristics and the specific policy experiences has permitted the identification of different "models" of agro-food processing development. The definition of such models has led to the formulation of development policy guidelines that could be applied in Brazil.

As a pioneer study, with regard to both the preparation of the data base and the comparison of policies, it has encountered several difficulties. Nevertheless it can be stated that the study is characterized by a good degree of internal coherence and completeness since it gathers the main interdependences among the macro and the micro aspects and is thus a useful instrument to evaluate the main developments associated with single projects. However the field of the present study is limited to the evaluation of the macro and micro connections and at this stage it is only possible to furnish general policy guidelines and some criteria for the preparation and evaluation of specific future projects.

In the first part of the present Executive Summary the basic features of the methodological approach are described. The nature, data sources and potentialities of the information systems are discussed together with the quantitative methods of analysis applied.

The second part is concerned with the analysis of the structural characteristics and the policy experiences in the different countries (Brazil, Argentina, Australia, France, Italy, Spain, Sweden, United States and Yugoslavia). The following aspects in particular are analyzed: the role of the food sector within each economy, the main factors determining the level and composition of demand, the characteristics of supply, and the dynamics and patterns of international trade. After such analyses it has been possible to identify the main "area problems" and compare the relative policy measures being applied to deal with such problems.

The main outcomes of the work are synthesized in the definition of policy guidelines to deal with the major area problems identified for Brazil. It must be pointed out that recommendations are stated only in terms of guidelines even if their relative operational constraints are evidenced. More specific recommendations would require spatial and inter-sectoral elements to be further evaluated in order to better define the contents, the form and the outcomes of the future interventions.

II. THE METHODOLOGICAL APPROACH AND THE INTEGRATED INFORMATION SYSTEM

Since it was one of the basic objectives of the project to formulate a methodology to study in a systematic way the basic elements of food processing development, the methodological work has consisted of :

a. the definition of an integrated information system regarding agro-food processing in the different countries of the sample

b. the selection of a comprehensive set of quantitative methods for the analysis of the existing relationships among the main aggregates constituting the agro-food processing system.

With regard to the information system it should be pointed out that it was intended to;

i) cover   the whole agro-food processing system and its single sub-systems (supply, demand, international trade, technology);

ii) refer   to different phenomena in different countries through a substantial and formal homogeneity,   thus allowing for analyses of the cross-section type

iii) allow   the time series to be reconstructed for a   sufficient number   of years in the past   and to continuously up-date them.

Obviously the definition of an information system with the above-mentioned characteristics has also been functional to the answers   sought   and the relative analytical instruments available.

In this sense, the specific methodological   frameworks   characterizing the main parts of the analyses can be described as follows.

i) The level of, and the existing conditions for, supply have been gathered through the analyses of the productive structure and production interdependences, the information being provided by the inter-industry flows matrices of each country and the analysis carried with the aid of input-output techniques.

ii) The level and composition of demand have been studied within the methodological framework provided by economic theory in the field of consumer   behaviour. The data used in this part of the analyses have consisted of time series regarding available income, private consumption, food consumption, income distribution and so on for each country.

iii) The dynamics and specialization of international trade in agro-food products have been analyzed with the help of traditional statistical instruments applied to data on imports and exports, in terms of volume, values and unit values.

iv) The technological aspects of agro-food processing have been limited to an "inventory" of the main processing technological possibilities open to a set of specific products of particular concern to this project and the major developments due to technological aspects (innovations, influence on the nutritional contents, etc.).

2.1 The supply side

The structure and composition of both agriculture and the food processing industries in the countries concerned and their role in the national economies have been analyzed within the methodological framework provided by the inter-industry flows' analysis. This type of analysis has been preferred because it allows interesting insights into the role and position of agriculture and the food-processing industry both with regard to the whole economic system and to any other industry. In addition, the application of input-output techniques allows the study of the functional relationships within the system with a certain degree of homogeneity when dealing with more than one country and shows the degree of integration of the food producing sectors with the whole economic structure in each of the countries considered.

In particular the input-output analysis has allowed the measurement of the inter-industry linkages. For instance, it has been possible to measure for each food producing sector the direct and indirect impact, in terms of output, value added and imports, of an increase of one unit in the final demand for their produce, on each of the industries in the country considered and the impact that would be generated in the food producing sectors if final demand in each of the other industries in a given country were to increase by one unit.

On the basis of the value added total requirements and the share of value added on total production it has also been possible to estimate the income multipliers associated with increases in output of each of the food processing sectors.

The information provided by the input-output tables has been integrated with national statistics concerning national accounts of industrial and agricultural production with the aim of illustrating the relationships between food producing developments and economic growth.

An intermediate task of the study that must be mentioned is the collection and comparison of input-output tables for Argentina, Australia, Brazil, France, Italy, Spain, Sweden and the United States. In this aspect a great effort has been made to overcome the difficulties due to the different criteria used in the accounting systems classification and other differences.

2.2 The Demand Side

The analysis of the determinants of food consumption in the countries concerned, both for the complex of food products and for a group of specific products, has been carried out within the theoretical framework provided by economic theory in the field of consumer behaviour. The analysis has regarded, at the aggregated level, the quantification, with the aid of econometric methods, of the existing relationships between food consumption, total consumption, available income, relative prices and income distribution.

At a more disaggregated level, and within the same methodological framework, the identification of specific consumption patterns of the specific products has been attempted.

As mentioned above to carry out such analyses a wide data base was prepared. Among the data gathered and /or estimated, the following can be mentioned: household food consumption apparent consumption of specific food products, available income, total household expenditure, deflators of GDP and private expenditure (total and food), population, exchange rates, and income distribution. Apart from the aforementioned analyses, such data furnish per se a fair picture of the economic factors determining the structure of consumers' demand for food and non food goods and services.
Also for the demand side it has to be pointed out the effort relative to the building of an homogeneous data base for each country particularly for countries like Brazil and Argentina where time series on not always available. For these countries the analysis started from an indirect re-construction of such series with regard to both volume and prices figures.

2.3 International Trade

With the aim of evaluating the link between the agro-industrial
economy of the countries under study and the international trade
of food products,the project has also regarded the dynamic ana-
lysis of international trade and specialization by the countri-
es concerned.

The analysis has been structured in two parts; the first regar-
ding the dynamics of international trade in terms of volume, va-
lue and unit values during the period 1970-1980 and the other
regarding the composition, in terms of commodity mix, of the
foreingn trade of the countries concerned.

It was an original aim of this part of the study to analyze the dynamics and
composition of trade not only by commodities and by countries but also by areas by
origin/destination. The results have not been presented in a systematic way beca
use of the enormeous difficulties to build an homogeneous and comprehensive
data base reliable enough for quantitative analysis. The information has been
utilized in a less systematic way and SOMEA, if requested by UNIDO or EMBRAPA
is available to furnish such enormeous set of figures.

2.4 Technology

With regard to the technological aspects of food processing the
study has been limited to the analysis of most widely used tech-
noligical processes, packaging and storage techniques and their
impact on the nutritional content of a specific set of pro-
ducts.

For each of the fruits and vegetabls concerned   ,   the main pro
cessed   products   obtainable   by   industrial trans
formation (and their process flow sheet and material balance
illustrated), the effects of processing, packaging and storage
that influence their nutritional content and the main processing
techniques and innovations that most effectively maintain their
quality attributes, such as texture, flavour and nutritive va-
lue   have been described.

The future scenario for the food sectors, in terms of technolo-
gical development and market trend in the 80s, has also been ou-
tlined.

In order to study   the relationships between food processing,
technological development and economic growth, the analysis has
been integrated with a case study regarding innovation in the
Italian food industry which emphasizes the results of new pro-
duct development and the change in dietary behaviour as a coun-
try moves from an agriculture-based economy to an industrial
one.

On the basis of such information and analyses it should be possible, for the policy-maker, to identify the market trend for each category of fruit and vegetable product; to select the most promising and popular processed fruit and vegetable products to be considered for future investment in the food sector; to establish the appropriate technological lines for best quality retention and nutritional value; to identify equipment needs and type of management involved and to carry out an economic study aimed at assessing the profitability associated with each technological process.

III. THE AREA PROBLEMS AND   POLICY INSTRUMENTS IN THE FIELD OF AGRO-FOOD

The analyses described in the precedent section and the data used have allowed the identification of the main structural characteristics of the food producing systems of the sample countries. Together with the identification of "models" or "typologies" the comparisons between countries have also permitted through the analyses of the cross section type (including countries at different stages of development),the study of the dynamic aspects of food producing developments associatedwith different stages of economic growth.

3.1 The primary activities

One of the basic requirements for the development of the agro-food processing industry is the availability of agricultural products. From the analyses it results that only in the U.S., Australia and Brazil   domestic agricultural production is enough to cover the national requirements for apparent consumption; in fact these three countries appear to be the only net exporters of agricultural products. However it snould be observed that a positive balance with regard to the national requirements for agricultural products consumption may be related to two different situations. The first may be the case of agricultural systems sufficiently developed to ensure self-sufficiency through the production of a wide spectrum of commodities to satisfy national needs and the second is the case of those agricultural systems characterized as suppliers of agricultural commodities (large scale production of agricultural raw materials).

Among the countries characterized by the last type of agriculture ("export-oriented" or "commodity suppliers") the analyses carried out have permitted the definition of two different types of behavioural models.

The first characterizes the United States and Australia where in the face of the wide spectrum and importance of agricultural commodities produ ction (see in particular figures on production and exports of commodities such as cereals, sugar, milk and meat) there is in act a "package" of policies oriented not only towards providing farmers with the opportunity to earn incomes commensurate with incomes received in the non agricultural sectors of the economy but also towards the satisfaction of the necessity to remain competitive on domestic and export markets and to adjust the continuing excess production capacity of   agriculture in order to keep carry-over stocks

at manageable levels. It is in fact the application of policy
instruments aimed at controlling supply that renders domestic a
griculture   (more stable and less vulnerable)   to   flu-
ctuations n the international markets. Only   countries ap-
plying such policies manage to control the market of those com-
modities and avoid being victims of them. In fact, particularly
importing countries,for reasons of national security and resources
utilization ,   are likely to maintain (unless there are climatic
constraints) a certain level of agricultural production even at re-
latively high cost and because they are also concerned with the stability of
their imports. In most developed countries a selective expansion
of   agricultural production is encouraged in such a way as
to increase agricultural incomes both through sales to domestic
markets and, when competititve, to external markets and the pro-
duction goals established are dependent on the international
market prospectives.

The policy connected with this behavioural model requires agricultural markets to
be organized mainly on a commodity basis and a variety of specific policy
instruments conceived as part of"adjustment programmes". Among
such instruments the most widely used are prices support in ex-
change for supply control disciplines or direct payments to far-
mers willing to use their land for production of commodities
established by the regulatory institutions (see detailed policy
experiences chapter 4, Final Report).

In a second type of behavioural model the agriculture is basically a supplier
of few important commodities and mainly for exports in the sample of countries
considered Brazil and Argentina belong to this behavioural schema that is also
characterized by the absence of a coherent policy aimed if not to control or go-
vern the international markets of those commodities, at least to reduce or miti-
gate the dependence upon such markets. The excessive dependence on monocultiva-
tions without market control will reflect negatively on the structural change
and development prospectives.

Even if "commodity supplier with control" and "commodity sup-
plier without control" are general models that do not take fully
into account the peculiarities of each country in broad terms
Australia and the United States could be considered as part of
the first group and Brazil and Argentina of the second one.

From the analyses on the inter industry linkages it results that
even if, in general, agricultural industries record, on average,
higher values of total forward linkages than backward ones the
same linkages appear particulary low in the case of Argentina
and Brazil.

In particular it appears that Brazilian agricultural, when compared with those of more developed countries, is less integrated in the national productive system. This evidence is of particular relevance when it is recognized that the development of food processing activities is closely related to the previous development of agriculture. A developed agriculture is characterized by high values of inter-industry linkages and income multipliers. The multipliers esti ted for Brazilian agriculture are well below those estimated for more developed agricultures; in fact they are on average equal to 1.28. This means that for every one unit increase in the value added of the agricultural sector for the economy as a whole it increases by only 1.28.

3.2 Processing Industry

From the analyses carried out has emerged, besides the commodity supplier agricultures, a model characterizing intermediate levels of development, where agriculture is primarily oriented towards satisfying domestic demand for consumption and secondarily towards supplying raw materials to the processing industry.

In countries characterized by such model of food production development both agriculture and food processing industries record a relatively low level of technological evolution as is illustred by the low values of inter-industry linkages and value added multipliers. This is seen to be the case of Spain and perhaps Yugoslavia for which country data on inter-industry flows was not readily available; in fact Spanish food industries are less backward linked than American or Australian ones, meaning that the production processes are relatively "poor" requiring the intervention through the supply of intermediate goods and services, of a smaller number of other sectors. They also appear to deliver intermediate inputs to a relatively reduced number of other industries both agriculture and food industries being oriented prevailingly towards satisfying final demand and, in particular, private consumption.

This sort of development assumes a relative importance in the agricultural sector in the face of an industrial base not even fully "mature" or consolidated but in the direction of a more diversified agricultural production and with a better forward integration with the food processing industries.

Even if trade of agro-food products may be relevant, it does not seem to play a dominant role as impulse or guide for development of such agro-food systems. The major impulse or guide to food production, apart from the general constraints imposed by the more general problems of economic development, appears to be the ones associated with evolution of domestic demand.

From the cross-section analyses on the determinants of food consumption it appears that food consumption, although it shows an increase in all the countries during the period 1970-78, decreased in relative terms with regard to income and to total consumption.

Other important factors determining the dynamics of food consumption have proved to be those of relative prices and the structure of income distribution between the classes. The latter is particularly important when it is considered that food consumption is then sensitive to policy measures aimed at the modification of the income distribution structure. With regard to such structures it has to be pointed out that while all the countries record values of the index R of Lorenz swinging in a rather small range (from 0.58 in Argentina to 0.70 in Australia) only Brazil can be placed in a position outside this small range (0.39).

Because of the importance of income distribution on demand and of supply prices on purchasing power of a large share of Brazilian consumers a mode of the Linear Expenditure System - type has been quantified in addition to more traditional econometric analysis of domestic consumption.

The model allows the estimation of the level of "fixed" consumption, fixed meaning the minimum assumed, given a certain economic structure, for both food and non-food products, and where such fixed consumption is absolutely non elastic with regard to income, or prices. It also allows the estimation of the shares of allocation, among food and non-food, of super numerary income (that is the real income that defines the previously defined fixed consumption expenditure.

This type of behavioural model is characterized by a great in-
certitude on future trends of demand of food products due to the
characteristics of consumption functions and the relative weak-
ness of the productive structure besides the primary agricultu-
ral productions. Another type of agro-food model individuated
has been the one characterized, whether or not in presence of
a relevant agricultural production, by a highly developed agro-
food processing industry, well backward and forward linked (as
shown by both the number and the amount of transactions with
other industries in the economy). The countries characterized
by such model of agro-food development are Italy, France, Swe-
den, Australia and the United States, even if the last two are
also characterized by the supply of basic commodities in the
world markets.

In this countries the agro-food systems may be prevailingly o-
riented towards domestic market or the international ones and
that is not necessarily determined by the availability of a re-
levant agricultural production.

In these countries the development of the food processing indu-
stries has been guaranteed by a general process of economic gro-
wth but also by the important role played by domestic final de-
mand that constitutes a relatively stable market for its produ-
ce.

3.3 Fruit and Vegetable Development

With regard to the processing of fruit and vegetables it can be
observed that the contribution of other sectors to the formation
of the value added of this industry varies with the degree of
economic growth and industrialization. In fact as the processing
of fruit and vegetable develops, the share of value added crea-
ted within the food producing sector (agriculture and food pro-
cessing) diminishes and the contribution to such value added
by other sectors increases. In Brazil agriculture and the food
industry contribute by about 78% to the formation of the value
added of this industry while in the United States such contri-
bution reaches only 41%; this results in a very low value of the
multiplier effect, in terms of value added, of the Brazilian
fruit and vegetable processing industry when compared to the va-
lues for countries like the United States, Australia, Sweden,
Italy or Spain.

The estimation of functions of demand for the specific food products and the relative elasticity of demand with regard to both total consumption and income distribution has been made possible after calculation of the apparent consumption of such products. It is obvious that the factors determining the consumption of specific goods are not only of an economic nature but are also often related to habits and traditions specific to a certain area or to a certain population. So, if on one side it is possible to estimate a function of demand and reach an estimate of its elasticity, on the other side the generalizations achieved through these values should in any case be limited.

On the other hand it would be illogical to deny the hypothesis of a functional dependence between variables such as the consumption of particular goods on one side and food consumption and income distribution on the other.

From the analyses developed it has been shown that onions, garlic and dried beans can be considered "poor goods" in the sense that the consumption of these products decreases with the growth of food consumption, even if afterwards (at least for the first two) there is an increase effect due to improvements in the distribution of income.

The demand for potatoes and dried peas (medium goods) records positive elasticity, but very low with regard to food consum tion; negative elasticity but decisively higher with regar distribution. These appear to be the typical goods whose con. ption is important at the beginning of development, but on₁ finds secondary placement in the "mature" phase of development.

Conversely goods like oranges or orange juices ("rich" goods) are directly tied to food consumption and to income distribution with a rather high elasticity with regard to both variables; this may, to a large extent, be due to the fact that for most countries they are imported goods.

With regard to the international trade of the products under study it appears that Brazil is characterized by export recording higher rates of increase than imports.

It must be pointed out that some products that may be considered "poor" or "medium" record increases on both imports and domestic production, thus indicating an increase in the domestic consumption of such products probably generated by low income levels

(potatoes, dried beans, garlic). In the case of onions, a strong increase in doemstic production is observed (together with a reduction of imports); this may indicate a typical process of import substitution supported by the domestic demand.

Observing the dynamics of trade in some specific products in the light of the relationships between the demand for the consumption of such products and the factors determining it, it appears that in general the increase of available income brings about changes in the structure of consumption from "poor" to "rich" products. The domestic production of "poor" goods may then fall and probably preference is given to import rather than their domestic production. Exceptions will be the cases in which the "poor" products become raw material for the production of "rich" goods, that is processed goods widely consummed (e.g. potatoes and chips).

3.4 Main area problems of food processing development in Brazil

a. The basis for the development of the food processing industry

As mentioned before, with the aid of the input-output the degree of development of the food processing industry has been measured in all the countries considered. The measure so obtained allows also for a diagnostic of the main technical and economic relationships of the food processing industry, and of any other industry, with the rest of the economic system.

The cross-section analyses carried out show that as economies develop the food producing industry, as any other industry, is characterized by a high degree of integration with the rest of the economic system. A high degree of integration means a high number of inter-industry linkages (a high number of industries from which it receives and/or delivers intermediate inputs) resulting in a higher capacity to induce growth in the other industries and to grow when other industries expand activity.

Among the countries studied Brazil appears in the last positions with regard to the integration of agriculture and food processing industries with the rest of the economy. It must be pointed out that for its very nature the degree of integration is not

only a question of development and thus technology but also depends on the very nature of the industry's activity; for instance, even at higher levels of development the food processing industry will record, on average, lower forward inter-industry linkages since it is a final demand-oriented industry. The analogous is true for the backward inter-industry linkages of agriculture.

From the analyses and after the considerations above mentioned it appears that Brazilian agriculture, when compared with those of more developed countries, is less integrated in the national productive system. This evidence is of particular relevance when it is recognized that the development of food processing activities is closely related to the previous development of agriculture. As is well known, the development of agriculture is necessary to guarantee the existence of a stable market of raw materials that meets increasing demand with adequate quantities and qualities and at competitive prices. In this sense Brazilian agriculture appears to be affected not only by technological problems but also, and perhaps more important, by problems regarding the organization and management of production and markets. In fact the biggest problems and those most difficult to overcome are not technological problems in the strict sense (capital and know-how can be bought or borrowed) but the problems of modernization in the methods of organization and management since they require enormous resources and considerable time to show results.

Therefore it is desirable for the Brazilian authorities to study policies, apart from the technological assistance and financial aid already in force, aimed at the promotion of modern forms of organization and management of production and marketing in agriculture. Among the types of organization to be promoted, the co-operatives (see the Swedish experience), the associations between producers (Italian and French experiences), and state agencies for the marketing of agricultural products (Yugoslavia) could be considered and adapted to the Brazilian case. For some products institutions similar to the Marketing Boards of Australia and USA could be promoted with the aim of stabilizing markets.

The problems of organization and management do not regard the forward inter-industry linkages of agriculture only, but also the backward ones. Thus policies and institutions aimed at easing the acquisition of inputs, the sharing of machinery specialized services, warehouses and the like may play a relevant role in the modernization of agriculture.

The promotion of the above-mentioned activities and organizations could well be carried out by EMBRAPA that knows the technological problems of Brazilian farmers and has a nationwide structure.

Analogous considerations may be applied with regard to the food processing industry itself. In fact, in addition to the availability of resources and know-how, the development of the industry requires entrepreneurial capacities, infrastructures and business services. Thus, the formulation of policies aimed at training in management and of workers, the organization and regula - tion of markets and so on, are desiderable.

b.   Domestic demand

The analysis of the economic factors determining the demand for food consumption in general and for the specific set of products considered appears to be of particular relevance to the development of the food producing sectors in Brazil.

It is well known that consumption grows when available income increases and/or income distribution improves; the analyses carried out confirm this relationship regarding the behaviour of demand but in the specific case of Brazil the following conditions appear more relevant than elsewhere:

i)   a high degree of income concentration;
ii)   a high elasticity of demand for food consumption with re-
      gard to the above mentioned factor; and
iii) a high elasticity of demand for food consumption with re-
      gard to relative prices.

Therefore in the absence of stimuli to domestic demand the efforts to promote development of the food producing sectors may not only be useless but,even worse,may create serious structural problems for the existing agricultural and food producing industries. On the other hand,any policy directed to, or having an indirect effect on, the pattern of income distribution may create equally serious problems if not gradually handled or accompanied by increase in domestic supply.

In countries where the agro-food system has reached a high degree of development it adjusts quickly to short-term variations of demand (USA, Australia) but where the system is not sufficiently developed it cannot easily meet demand fluctuations (Brazil, Argentina).

If income distribution in Brazil were to improve, even if only
a little, the economy might face two risks; a) price increases
and thus higher rates of inflation and/or b) import increases and
thus worsening of the trade balance.

Conversely, if the supply of the food industries grows but not
sufficiently to meet demand and the agricultural sector cannot
increase output at the rate the food industry does, the economy may
record: a) retail prices increase even if at lower rates than
in the preceding case; b) imports of intermediate inputs in-
crease at higher rates than imports of final goods; c) increase
of prices of agricultural raw materials, both domestic and im-
ported ones.

In conclusion, neither intervention on the supply side nor on the
demand side are sufficient by themselves to hasten development
in the food producing sectors. A development policy will succed
only on condition that it influences both sides and, last but not
least, a key ingredient of such policy must be   timing, since
policies influencing demand show their effects in the very short
run while policies influencing   supply hardly show effects
if not in the medium and long run.

c.   International trade and the production mix

The analysis of international trade and specialization shows
for Brazil a positive trade balance of the food sector and ex-
port growing at faster rates than imports.

However it must be pointed out that the export of traditional
commodities contributes heavily to the pattern of trade.

Even if exports constitute by themselves a good thing, an exces-
sive dependence on them may constitute a risk, particularly if
the bulk of them are made up of traditional commodities which
are more sensitive than other products to world demand fluctua-
tions. It follows that the development of the food processing
industry and food producing sectors in general should not rely too
much on external markets especially when there is such a big po-
tential domestic market.

At this stage it is necessary to point out the   dynamics
recorded   by   different products to indicate for which de-
velopments there is a domestic market and which developments
should continue to rely on external markets.

The analysis of demand has allowed the classification of the products under study into "rich", "medium" and "poor" goods according to the elasticities of demand with regard to available income, income distribution and relative prices.

From the analyses of data on international trade and Brazilian production, it appears that Brazil has increased both imports and domestic production of "poor" and "medium" goods, that is, products for which there is a wide domestic market, while it has increased production and exports of "rich" goods, particularly oranges and orange juice.

Onions are the only "poor" goods to record a decrease in imports together with a relevant increase in domestic production; this may indicate a process of import substitution.

In conclusion, the development of the food producing sector in Brazil, given the present pattern of income distribution, should rely mainly on "poor" and "medium" goods to satisfy domestic demand and avoid imports, and on relatively "rich" goods to satisfy external markets. It should be pointed out that the set of products here analyzed is limited and many others could be studied to individuate their market spaces. The above does not necessarily mean the domestic pattern of demand will remain steady; small changes in income distribution may considerably change the combination of consumer goods and in the absence of domestic supply the import system might move to "rich" goods and thus to a worsening of the trade balance.

IV. CONCLUSIONS AND FURTHER DEVELOPMENTS OF THE ANALYSIS

4.1. Final Remarks on the Brazilian agro-food system

The Brazilian agro-food production system, when compared to the systems of the other countries of the sample, appears characterized by a substantial lack of integration between the agricultural sector and the food processing system . In particular, the agricultural sector appears quite specialized in the supply of a limited number of basic commodities and prevailingly directed to the export markets. This is partly determined by the comparative advantages and the natural resources endowment and, obviously, by the cultivation tradition of   Brazilian agriculture (which are not necessarily elements of weakness of the sector); even if, the agricultural system does not appear to be a typical case of monocultivation some behavioural patterns typically associated to the monocultivation model are still strongly present in Brazil.

The above has implied a prevailing dependence of supply, with regard to both quantities and prices behaviour, on the developments of international trade and on the capacity of appropriation of the surplus by the commercial intermediates and/or the consumer countries.

The relatively minor weight of agricultural goods susceptible to several stages of industrial processing (from preserving to industrial processing in the strict sense) constitutes an-element of weakness characterizing the agro-food processing system as a whole.

Three other elements characterize further the Brazilian agro-food processing system:

a. The generalized relative backwardness of the industrial sectors and the weakness of the inter-industry linkages between the different components of the productive system. It has to be pointed out that by inter-industry weakness   is meant the more general problem related to the lack of complexity of the Brazilian industrial system; this has been deduced, apart from the specific analyses relative to the agro-food processing, from the presence of strong backward and forward production linkages only for a few industries (this being the result of developments in modern sectors of the economy of industries "moved" by the public sector or, in some cases the re

sult of foreign firms'investments aimed at exploiting the comparative advantages but only relative to specific productions).

b. The weakness of the infrastructures'system in the face of far apart, in terms of spatial distribution, potential centres of agricultural production, centres of agro-food processing and barycentres of consumption. Even if it was not a subject matter of this study to analyze the natural characteristics of the areas to be potentially used for cultivations susceptible to industrial processing, or in any case for productions oriented towards supplying domestic markets, evidence suggests the existence, in Brazil, of enormous agricultural potential.

The concentration of urban areas, and thus of areas potentially more interested in industrial development, determines enormous problems of spatial interconnections between areas of agricultural production, areas of food processing and areas of consumption. Further, the insufficiency of infrastructures determines not only high transport costs but also external diseconomies of such a magnitude as to annul the economies resulting from low levels of wages to less qualified workers.

c. The relatively reduced dimensions of the agro-food domestic market resulting from both a lower level of per-capita income and the specific income distribution. The importance of these two elements with regard to the dimensions of the market is clearly illustrated by the long term behavioural model resulting from the cross-section and time series analyses. The dimensions of the domestic market influence the system not only in terms of economies of scale but also in terms of external economies deriving from the integration of the production process and the dimensions of the agro-food system. Further, as evidence regarding other countries shows, the development of domestic markets constitutes a fundamental step to develop the capacity to enter international markets.

4.2. Policy measures within the framework of the medium and long term development prospectives

From the simplified behavioural model of the Brazilian agro-processing system described above it does not appear that the policies, or in any case the outcomes from their application, have been able, at least until the present, to determine notable progress towards more developed models of the system or in any case to models comparable to those associated with more developed countries of the sample. The complexity and peculiarity of the Brazilian case does not allow the reference to specific experiences of any one country but on the basis of development and policy experiences in the countries considered it is possible to individuate the following needed policy areas:

a. Instability of demand and consequently of the supply of export-oriented commodities, and thus in price behaviour influencing the terms of trade. In this regard policy measures may cover a wide field, from which the following can be mentioned: information on international demand supply and price behaviour, public control of the stocks and so on. Obviously it is necessary to acknowledge the difficulties and consequences at the international level associated to this kind of policy ; however it is clear that in this case the international agencies' action cannot be sufficient.

An integrated public policy framework for this sector must also include policies aimed at hastening the forward development, particularly with regard to the preserving, first transformation and marketing branches.

The technical and/or technological characteristics of these productions do not permit, except in the very long run, the formulation of policies oriented towards agricultural co-operation (apart from the fact that , in this field, relevant foreign experiences to use as a useful reference do not seem to exist.

b. Infrastructural investments, where it is necessary to keep apart those regarding works influencing directly the value of agricultural land (irrigation, consolidation, etc.) and those more strictly linked to the system of transport. In this regard the formidable difficulties associated with the investment costs of infrastructures linking far

apart   centres must be acknowledged. A calculus of the re-
lative opportunity to undertake such kind of investments must
take into account all the elements of the real
feasibility associated with industrial development process
that ensures and departs from a balanced development   of
agriculture and the food sectors .

Long periods of ammortization (periods long enough to take
into account the long term benefits) should be considered
in the evaluation of the investments necessary, to strengthen
the infrastructures network, in such a way as to include among
the benefits also those associated with a balanced development
of the production structure When evaluations are carried out
with such criteria it is possible for the outcomes to be quite dif-
ferent from those obtained through a typical profitability
calculus limited to the short run. This is also true of in-
vestments regarding irrigation, consolidation, energy and so
on where most probably the social and economic costs could
show well below those recorded at the present.

When evaluating infrastructural investments, particularly
those aimed at changes in the production mix, it is necessary to
take into account the present spatial distribution of popula-
tion (and past and present trends) and the socio-economic
problems linked to the availability (and/or willingness) of
the local labour force to undertake such changes. In this re-
gard the Italian experience appears to be of interest; in the
Southern regions of this country the time lags between the
infrastructural investments and the changes in cultivation
effectively undertaken were longer than thought . As far as
the policy measures oriented to hasten co-operation in the
fields of production and marketing of non basic products are
concerned, several behavioural models can be deduced from the
different country 's experiences.

It was not an objective of this study to analyze the problem
of such changes in the Brazilian context,   but any plann-
ing effort aimed at structural changes in cultivation
should fully assess the necessary time lags and the socio-eco-
nomic and cultural characteristics of the populations invol-
ved.

Any conclusions drawn from study regarding policies with the aim
of promoting integration between agricultural production and in-
dustrial processing sectors need to be further qualified, both
with reference to the instruments and the contents; this very
relevant problem is valid not only for the agro-food system but
also for the economic system as a whole.

c. Domestic demand; the expected trend in the evolution of demand
for products of the agro-food system and the potential reduction
of the present levels of autoconsumption depend on the following
three factors:

i) growing urbanization of the Brazilian population in the last
    20 years the rate of growth of the total Brazilian popula-
    tion has been 2,9% on average, while urban population has
    increased by 4,6% a year during the same period;

ii) the rate of increase of per-capita income that should con-
    time to grow at rates as high as the ones reached during
    the period 1970-1980 unless profound structural crisis of
    the international economy prevent it, and

iii) a related process of income re-distribution as a late but
    foreseen result of the two above-mentioned factors.

In particular if the income distribution factor were to reach
a relevant dimension it could result in the growth of food
consumption being associated with an elasticity with regard to the
gross product above the unity; in such cases the figures of the
agro-food trade balance, which by now already prove to be biased beca-
use of relevant export flows of raw materials and agricultu-
ral commodities, might constitute another element of structural
disequilibria of the external accounts.

A second general consideration emerging from the analysis of the
Brazilian situation regards the need to develop the preserva-
tion/supplying structures for the big urban areas;this appea -
ring as a priority objective with regard to that of the imple-
mentation of an advanced food processing industry (this consi-
deration is true on a macro-scale but it does not exclude the
development advantages accruing to specific sub-sectors).

Taking into account the above considerations, the foreign expe

riences and the figures regarding the Brazilian situation, the priorities may be stated not in terms of the importance of the objectives but rather in terms of timing of such interventions as;

i) transport infrastructure and strengthening of distribution and primary processing structures (preservation, storage, etc.);

ii) interventions and infrastructures aimed at cultivation changes and

iii) widening, on the large scale, of the industrial production base necessary to the implementation of an advanced food processing industry.

The placing of the last intervention in third position is releted not only to the need to gather fully, and without useless waste , the time-lags between the development of production for industrial processing and   that   of the industrial processing activities   themselves,   but   also   to   gathering   the advantages related   to the   widening of the industrial base of the food processing sector   needed to take advantage, on nationwide basis, of the backward integration between the food processing industry and the rest of the Brazilian economy; in particular, such advantages are related to the availability of the necessary mechanical and chemical industries to supply the needs of the agro-food producing sectors as demonstrated by the country experiences analyzed in this study.

4.3 Further development of the analysis

To take full advantage of the study carried out, in terms of the information provided and the outcomes of the analyses, for the definition of the project or intervention programme for the Brazilian food processing industry would require the enlargement of the analyses on two levels;

i) a first level, that evaluates the medium and long-term development prospects articulated by macro-sectors and puts the specific intervention strategies by sector within the more general framework provided by the economic and industrial policies of the country and,

ii) A second level consisting of the definition of a set of pre-feasibility studies related to a number of large development projects of the agricultural and food processing industry.

In the first type of analyses a decisive role is played by the quantification of the development prospectives of the Brazilian economy which consist, on one hand, on the definition of the policy measures shaping the general framework (that is, fiscal policy, import-substitution policies, manpower policies, industrial policy in general) and on the other hand, in the definition of the reference variables for the technical and economic evaluation of the specific development projects mentioned above.

An essential point of such analyses should be the evaluation of the demographic dynamics and the spatial distribution of population. In the same way, the spatial distribution of industrial settlements should not be ignored and special attention should be paid to their specific productive and technological characteristics in the different areas.

An even deeper knowledge of the behavioural models of consumption and production at the spatial level (taking into account their spatial interactions with the physical and infrastructural environment) does not only help to define the determinants of demand development and the adjustment capacity of the production system, should also allow for an evaluation of the impact of the agro-food system development at the nationwide and regional level.

On the basis of such reference framework, the need to · extend the study of the prospectives and intervention policies to a point consisting of the definition of a set of specific key projects is suggested. Such projects could regard, for example, the following areas:

A. The system of transport infrastructures, limited to the more relevant axis and nodes. Such a project should be articulated in three sub-systems of transport infrastructures; the first related to the transportation of commodities for export, the second related to the transportation of goods between areas of production for domestic markets and barycentres of consumption; and the third related to the transportation sub-system of connection between areas of agricultural production (both actual and potential) for industrial processing and possible eventual areas of industrial location and areas of consumption.

B. The basic commodities sector, the re-organization of produc-
    tion, marketing   on the international markets, the mana-
    gement of stocks, and manpower policies. This project could
    regard a few sample development areas of actual or potential
    agricultural production of export commodities.

C. Comprehensive development projects in the sub-sectors pro-
    ducing goods to supply the big urban areas. Such projects
    regard not only   agricultural production in the strict
    sense but also the preserving, storage and marketing struc-
    tures.

D. Sample projects in the field of food processing not only
    including the evaluation of investments in technology and the
    locational aspects but   also taking into account the es-
    sential characteristics of eventual future industrial areas
    for which the external economies and diseconomies complex
    related to the localization of such areas should be evalua-
    ted.

At the present stage it is not possible to propose an approach
according to type of intervention or specific productions. Ho-
wever, the kind of projects above indicated seem, in general,
to be more efficient particularly when regarding long-term ex-
perimented production for which detailed knowledge of the phy-
sical environment is available. For each project two kinds of
evaluation could be carried out, the first regarding the econo-
mic efficiency in the strict sense and the second, more compre-
hensive, of the cost-benefit or cost-effectiveness type. The
reference framework provided from the macro-sector analysis
should provide the basic figures for the estimation of direct
costs and benefits and the indicators for the quantification
of the indirect and induced benefits which are of particular
interest for the policy-maker and the planner. It must be poin-
ted out that the analyses carried out during the present pro
ject should play a decisive role in the evaluation of such in-
direct and induced benefits.