OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

Distr.
LIMITED

UNIDO/IS.607
12 February 1986

ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

15322

THE MULTIPURPOSE APPROACH TO AGRICULTURAL MACHINERY MANUFACTURING IN LATIN AMERICA

Sectoral Working Paper Series

No. 46

Sectoral Studies Branch
Division for Industrial Studies

V.86-51667

SECTORAL WORKING PAPERS

In the course of the work on major sectoral studies carried out by the UNIDO 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 in the Sectoral Working Papers series. These papers are more exploratory and tentative than the sectoral studies. They are therefore subject to revision and modification before being incorporated into the sectoral studies.

This paper was prepared in collaboration with Mr. M. Romani as consultant to UNIDO. Views expressed may not necessarily reflect the views of the UNIDO secretariat.

Preface

The purpose of this study is to provide the basis for an examination of the multipurpose plants in the agricultural machinery industry in small- and medium-scale enterprises in Latin America, and the possibilities of international co-operation among the countries of the region.

The multipurpose plants approach in the agricultural machinery industry was proposed in the Second Consultation Meeting, held in October 1983 in Vienna, as a possible strategy for the development of the sector. Moreover, the participants in the Second Consultation recommended the elaboration of a framework for industrial co-operation in the field of agricultural machinery to facilitate the establishment of contacts and to improve the effectiveness of such co-operation, emphasizing in particular the mobilization of small- and medium-scale enterprises.

This study has been undertaken by the Sectoral Studies Branch, Division for Industrial Studies, UNIDO in collaboration with Mr. M. Romani, as a UNIDO consultant. The analysis is based on a field survey. The consultant visited agricultural machinery producers in Brazil, Chile, Colombia, Costa Rica and Guatemala, in order to have on the spot first hand information of the enterprises. The possibilities to introduce multipurpose plants and the issue of regional co-operation in this area were also discussed.

Contents

		Page
1.	INTRODUCTION	1
2.	COMMON PROBLEMS AND ISSUES IN THE AGRICULTURAL MACHINERY INDUSTRY	3
2.1	Global problems	3
2.1.1	The economic crisis	3
2.1.2	Agricultural policy	4
2.2	Industrial problems	4
2.2.1	Size of enterprises	4
2.2.2	Structure of enterprises	5
2.2.3	Labour	5
2.2.4	The products	7
2.2.5	Manufacturing engineering	16
2.2.6	Technical support	19
2.2.7	Market information	19
3.	PROSPECTS AND POTENTIALS FOR THE MULTIPURPOSE APPROACH IN THE AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY	21
3.1	Characteristics of and prerequisites for the multipurpose approach	21
3.1.1	Main characteristics	21
3.1.2	Basic prerequisites	22
3.1.3	Sectoral prerequisites	23
3.2	General restrictions	24
3.2.1	Size of markets	24
3.2.2	Foreign trade policies	26
3.2.3	The industrial context	28
3.3	Present situation vis-à-vis the multipurpose approach	29
3.3.1	Present characteristics of industries	29
3.3.2	Sector definitions	32
3.4	Potentials	35
3.4.1	Favourable economic conditions	35
3.4.2	Attitude of manufacturers to the multipurpose approach	36

		Page
4.	MAIN FINDINGS AND RECOMMENDATIONS	39
	4.1 Scope of the multipurpose approach	39
	4.2 Main factors affecting the introduction of a multipurpose approach in Latin America	41
	4.3 Possibilities to introduce the multipurpose agricultural machinery plants in small and medium scales enterprises in Latin America	43
	4.3.1 General considerations	43
	4.3.2 Technical co-operation from Brazil	45
5.	THE LATIN AMERICAN AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY	48
	5.1 Brazil	48
	5.1.1 The industry, its size and characteristics	48
	5.1.2 Development of the industry	49
	5.1.3 Composition of production	53
	5.1.4 Agricultural mechanization	56
	5.1.5 Foreign trade	56
	5.2 Chile	62
	5.2.1 Development of the agricultural machinery and implements industry	62
	5.2.2 The industry: manufactured products and their characteristics	64
	5.2.3 Growth of imports	71
	5.2.4 Composition of imports	73
	5.2.5 Distribution channels	76
	5.3 Colombia	79
	5.3.1 The agricultural machinery and implements industry	79
	5.3.2 Exports	81
	5.3.3 Imports	83
	5.3.4 Distribution channels	85
	5.4 Costa Rica	86
	5.4.1 Development of agricultural mechanization	86
	5.4.2 Domestic production	87
	5.4.3 Imports	89
	5.4.4 Exports	90

Page

5.5 Guatemala 93

5.5.1 Agricultural mechanization 93
5.5.2 Domestic production 95
5.5.3 Imports 96
5.5.4 Exports 98
5.5.5 Distribution channels and financing 99

6. FINAL REMARKS: THE NEED OF A NATIONAL AND REGIONAL STRATEGY TO DEVELOP THE MULTIPURPOSE APPROACH 101

6.1 National strategies 101

6.2 Regional strategy: co-operation 103

Annex 106

Tables

1. Brazil: Levels of complexity of product engineering activities and of technical assistance developed by the agricultural machinery industries of Rio Grande Do Sul - 1982 10

2. Complexity levels of product engineering and technical assistance activities 11

3. Apparent consumption of agricultural machinery and implements in selected countries 25

4. Import duties: Brazil, Chile, Colombia, Costa Rica and Guatemala. 1985 27

5. Latin America: Level of development in manufacturing 30

6. Brazil CTPD programme on technical co-operation among developing countries - allocation of funds, shares by regions - 1981-1983 46

7. Brazil: Industry of agricultural machinery and implements - 1980 50

8. Brazil: Production, imports and exports of tractors and harvesters. 1965-1984 51

9. Profile of the agricultural machinery and implements industry (other than tractors), Brazil 1970,1975, 1980 52

		Page
10.	Profile of the agricultural machinery and implements industry (other than tractors), changes (per cent) Brazil, 1980-1984	53
11.	Brazil: Value of sales of agricultural machinery and implements - 1975-1983	54
12.	Brazil: Value of sales of the main products among the agricultural machinery and implements - 1975-1983	55
13.	Brazil: Agricultural machinery and implements in operation	57
14.	Brazil: Imports of agricultural machines and implements 1975-1984	59
15.	Brazil: Exports of agricultural machines and implements 1975-1984	60
16.	Chile: Manufacturers of agricultural machines and equipments - 1985	65
17.	Chile: Number of products manufactured by the firms	68
18.	Chile: Specialization of manufacturers	68
19.	Chile: Imports of agricultural hand tools, machinery, implements and tractors 1976-1985	72
20.	Chile: Seeded area with traditional cultivations	72
21.	Chile: Planted area and fruit production	74
22.	Chile: Imports cost evolution 1979-1984	74
23.	Chile: Imports of agricultural machinery and implements by item. 1976-1984	77
24.	Chile: Dealers of tractors and agricultural implements, 1984	78
25.	Colombia: Exports of agricultural machinery, implements and tools. 1976-1984	82
26.	Colombia: Imports of agricultural machinery, implements and tools. 1976-1984	84
27.	Costa Rica: Tractors and harvesters imports 1971-1984	87
28.	Macro-economic indicators of Costa Rica economy, changes (per cent), 1979-1982	87

Page

29. Costa Rica: Manufacturers of agricultural machinery 89

30. Imports of agricultural machinery and implements, and share (per cent), Costa Rica 1981-1984 89

31. Costa Rica: Imports of agricultural machinery, implements, hand tools and tractors 1981-1984 91

32. Costa Rica: Exports of agricultural machinery, implements and tools. 1980, 1983, 1984 92

33. Guatemala: Agricultural machinery and implements in operation. 1979 94

34. Guatemala: Composition of imports. 1977-1984 96

35. Guatemala: Imports of agricultural machinery, implements, tools and tractors - 1977-1984 97

36. Guatemala: Exports of agricultural machinery and implements, 1977-1984 99

Figures

1. Level of complexity of product engineering and technical assistance in small and medium size enterprises, South-East region - Brazil, 1982 13

2. Chile: Imports of tractors 75

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.

A slash between dates (e.g., 1980/81) indicates a crop year, financial year or academic year.

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:

Three dots (...) indicate that data are not available or are not separately reported.

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

A blank indicates that the item is not applicable.

Totals may not add up precisely because of rounding.

1. INTRODUCTION

Despite considerable rural-urban migration during the last 25 years, nearly one third of the Latin American population is still living in the rural area. A large proportion of this population makes its living from agricultural activity.

Although showing an increase in the per capita production in the period 1960-1983, up to the beginning of this decade, the agricultural sector has developed at rates much below the gross domestic product (GDP).

This disparity becomes more important, when analyzing the food production, which has increased only one third above the population growth.

As a result of such limited dynamism and the reduction in the agricultural prices, the balance of trade of the sector in Latin America shows a significant decrease in surpluses. After having amounted to three times the expenses in the period 1977/78, the revenues from the agricultural exports were only twice that in the period 1981/82. In this context, particular importance is given to the dependence of the continent on cereals and by-products, where the deficit reached $US 1.3 billion in 1982.

One of the most important variables in the increase of agricultural production and productivity is the degree of mechanization.

According to data from FAO, in the periods 1974-1976 and 1976-1982 the agricultural mechanization, measured in tractors per cultivated hectares developed slowly, increasing from 4.8 to 5.2 tractors per 1,000 hectares. In many countries this ratio has stabilized or even declined.

In addition to this, the interregional trade of agricultural machinery and implements has decreased resulting in foreign exchange problems for the continent. According to ALADI's[1/] figures, out of the $US 851.5 million

---

1/ ALADI, Consideraciones sobre la Maquinaria Agrícola en los Paises de la ALADI, 1984.

that represent the exports of agricultural machinery and implements by the countries of the region, in 1980, less than 8 per cent were accounted for by interregional trade.

According to FAO's[2/] estimates, the Latin American agricultural machinery and implements market, for the period 1984-2000 will be about $US 11.4 billion. These figures show the important role to be played by the agricultural machinery industry in the region.

The purpose of this paper is therefore to analyze the possibilities of increasing the agricultural machinery and implements production in Latin America through the use of the multipurpose approach. This approach aims at establishing or expanding small- and medium-sized industries for various products by using plants for batch production to meet the needs of local agriculture.

This paper is divided into five parts. After this introduction the second part relates to the identificaton of the main problems faced by the sector; the third part deals with the potentials of and prerequisites for the multipurpose approach, as well as the advisable strategy to be adopted in order to develop the regional industries according to such an approach. In the fourth part of the study an action plan to enable the relatively less developed countries to adopt the approach in question is presented, and recommendations are made regarding international co-operation in this area. Part five presents the analysis of the situation of the industries in selected countries namely; Brazil, Chile, Colombia, Costa Rica and Guatemala. The major enterprises were visited and the main features of these industries illustrate the problems facing this sector in the region. Furthermore, these enterprises were surveyed with a view to introduce the multipurpose approach in the production processes, as an alternative to overcome the idle capacity of the industry. The last part presents the basic elements to define a national and regional strategy to develop the multipurpose plants in the region.

2/ FAO, Agriculture: Towards 2000, 1979.

2. COMMON PROBLEMS AND ISSUES IN THE AGRICULTURAL MACHINERY INDUSTRY

The agricultural machinery and implements industries of the countries studied each have their own characteristics, which makes it difficult to draw a common conclusion. This is mainly due to the inclusion of Brazil in the group of countries, since this industry has reached a high level of development in Brazil.[3/]

2.1 Global problems

2.1.1 The economic crisis

A common problem which has been and is still being faced by the agricultural machinery and implements industries of Latin America is the economic recession which has seriously affected the growth of the agricultural sector. The Latin American agricultural sector has grown at an average annual rate of 3.9 per cent in the period 1971-1975, 3.3 per cent in the period 1976-1980, reached 4.7 per cent in 1981 and dropped to -0.2 per cent in 1982 and 0.8 per cent in 1983. In the case of Chile, Costa Rica and Guatemala such decreases have been much more severe.

The problem faced by cattle raising and farming is, as rule, the reduction of the relative profitability. This is due to a sharp increase in production costs and an actual reduction in the prices received by the producers. In Colombia, for example, in the period of 1980-1983, the prices of agricultural products increased by 80.5 per cent, while the prices of industrial products increased by 96.7 per cent.

This situation has discouraged the agricultural mechanization leading to a reduction in the demand for both imported and local machines and implements. Thus, the industries of the countries being studied are suffering

---

3/ The analysis presented in this section is based on country surveys. The situation of the agricultural machinery in some Latin American countries is made in section 5. A detailed profile of the enterprises surveyed is given in the annex.

a significant reduction in their production, which in some cases is below 50 per cent of capacity. This situation has led to the stoppage of programmes for expansion or technological improvement of the above-mentioned industries.

However, the recovery that took place in 1984 and 1985 is leading to the reorganization of the above industries in the bigger countries of the region.

2.1.2 Agricultural policy

One of the most serious obstacles faced by the agricultural machinery and implements industries of every country is the lack of a definite and steady farming and livestock policy. This has led to hesitation in making investments in infrastructure and equipment and, in certain cases, contracting more skilled personnel, as well as engaging in product research and development.

The lack of continuity in some projects has resulted in significant losses for some companies, who have made investments particularly directed to such purposes. In Brazil, this occurred a few years ago in the irrigation sector, where the Profir Project led the irrigation equipment companies to manufacture water pumps and sprinklers which later had to be kept in stock due to the lack of a market.

2.2 Industrial problems

2.2.1 Size of enterprises

The size of factories reflects to a certain extent, the production volume and process, as well as the technological features used. Except in the case of Brazil, where the market is big, in the remaining countries, particularly in those of Central America, the size of the producing units is very small with inadequate production scales resulting in low productivity and high production costs.

In Colombia, where the sector is relatively developed, some enterprises have between 100 and 200 employees. However, the most common size is less than 25 employees.

In Chile, the biggest company has less than 80 employees and establishments having less than 25 employees are predominant.

In Costa Rica and Guatemala, particularly in the former country, the industry is practically non-existent and is limited to workshops. Accordingly, the size of the enterprises rarely reaches 20 persons. This is a characteristic situation of the countries in Central America.

2.2.2 Structure of enterprises

A common feature of all countries studied is the predominance of the family owned enterprise.

The restrictions of such a situation are apparent, they lead to preservation of traditional administrative and work methods. A research carried out in Brazil in 1982,[4/] found that 77 per cent of the enterprises manufacturing agricultural machinery and implements were family owned.

2.2.3 Labour

The companies surveyed reported no major problems with skilled labour. They stated that efficient work teams were available and that the labour market provides adequately skilled personnel at all levels.

To some extent this view may be due to poor qualifications of the managers themselves and the resulting low demands made on worker skills.

The work carried out by the vocational training centers such as: Servico Nacional de Aprendizagem Industrial - SENAI, in Brazil; Instituto Nacional de Capacitación - INACAP, in Chile; Servicio Nacional de Aprendizaje - SENA, in Colombia; Instituto Tecnico de Capacitación - INTECAP, in Guatemala and Instituto Nacional de Aprendizage - INA, in Costa Rica is being considered as efficient but very limited in their functions.

4/ Fundacao de Ciencia e Tecnologia - CIENTEC, Diagnóstico do Sector de Máquinas e Implementos Agricolas do Estado do Rio Grande do Sul - 1983.

A deeper investigation of the availability of skilled labour leads, however, to different conclusions. A survey carried out in 1982 in the industries located in the State of Rio Grande do Sul, in Brazil, showed the number of engineers in the enterprises to be as follows:

Number of Engineers	Enterprise proportion per cent
0	17
1	20
3-4	27
5-10	7
more than 10	20

As can be seen from the above figures 17 per cent of the enterprises had no engineer and 20 per cent had only one.

In Colombia, a similar situation exists, i.e. the main enterprise has only two engineers for the whole production area.

As regards skills level serious difficulties are also encountered. Thus, in Costa Rica, a significant lack of personnel with good knowledge of metallurgy exists at all levels (workers, technicians and engineers).

In all countries, there is a lack of professionals and schools for the designing of agricultural machinery projects and manufacture, from the technical level to higher courses.

Particularly, in the case of higher level workers it can be seen that in the agronomy courses the number of graduations in machinery courses is small. The agricultural engineering courses are much more directed to the use and operation of machines and implements, nothing being taught about projects and very little about manufacture. With respect to the mechanical engineering courses, the courses are general and very little is taught about agricultural machines. These problems become more serious when considering that in one country the school of agronomy of the main university has no operational tractor to be used for teaching purposes.

2.2.4 The products

General characteristics

Except in the case of Brazil, where a significant proportion of products at a more advanced technology level (such as tractors and harvester-threshers), is manufactured under foreign license, the products in general are copies of models developed by third parties.

However, such copies with some adaptations to fit the local characteristics are very rare. This lack of adaptation is to a certain extent due to the limited contact the enterprises have with farmers and their needs.

All countries, including Brazil, however, to a smaller extent, lack technical norms for the manufactured products.

Very limited technical personnel is available for carrying out product research and development. The small companies do not even have engineers in their technical staff. The enterprises in general have no contact with institutions that perform research in the machinery and implements area.

Product development

The engineering content of manufactured products seems to be very low, if the product development operations are analyzed.

(a) Research

As a general rule, the industries carry out no research and are not even equipped for this. Thus, the development of new products is based on work from third parties and in part on information obtained by contacts with the clients (technical assistance).

Only a limited number of medium and large-sized enterprises, particularly those located in Brazil, which manufacture more complex products have their own infrastructure for carrying out research. This means that as

enterprises manufacture more sophisticated products they are forced to invest in research and build an adequate infrastructure of their own.

(b) Design

The situation in this area is very similar to that described for research. In most industries, the products are either traditional models which make use of the national technology or copies of products developed by third parties, partly with some improvements. Thus, the proportion of enterprises with their own design capability is minimal except in Brazil where the proportion is higher,[5/] although it is still low for the more complex products.

(c) Measuring instrumentation

Most small enterprises do not have any measuring instruments and thus use inappropriate parameters. Some enterprises carry out simplified measuring calculations without using any technical norms or standards.

Among the medium-sized enterprises some have their own criteria and a very small proportion, mainly in Brazil, perform the measuring and selection of materials according to strict and accurate norms and criteria.

The situation is rather different in the enterprises manufacturing more complex products, which, as in the case of research and design, have reached some level of engineering content.

(d) Drawing

The preparation of drawings is perhaps the most developed operation in every country. Also among the small sized enterprises a certain proportion execute well-detailed drawings. A number of companies among the medium and

---

5/ CIENTEC, op. cit.

large-sized enterprises, have complete working drawings of the assemblies and of the specific details giving the required information for manufacture.

(e) Testing

Small-sized enterprises seem to be limited to performing elementary functioning tests of the products put on the market, but without using the prototypes. With regard to the medium and large-sized enterprises, approximately half of them test the prototypes under actual working conditions in the field.

However, some of these tests only aim at evaluating the product efficiency (performance testing). Except in Brazil, tests with a view to developing the product in order to reach an adequate performance by correcting the prototype and the project, are rare. The availability of test laboratories and measuring equipment seems to be very scarce.

Product engineering in Brazil

Brazil, due to the volume and diversity of its production, as well as its exports, is obviously the country in which the agricultural machinery and implements industry is most developed. Thus, the situation of product engineering in Brazil provides, to a certain extent, the highest limit reached in Latin America in that field and enables the drawing of conclusions for the remaining countries.6/

As seen in table 1, if the sector is taken as a whole, product engineering except for the drawing activity, is very little developed, since two thirds of the enterprises do not reach a medium level of complexity (table 2).

6/ For this purpose, information from two studies were used, one relating to the industries located in the Southern region of the country and the other relating to the industries situated in the South-East region, basically Sao Paulo. The studies cover practically the whole of the industry under analysis. Universidade Federal de Uberlândia. Avaliacao Tecnológica da Indústria de Máquinas Agrícolas no Estado de Sao Paulo, Triângulo Mineiro e Sul de Goiás. 1983.

Table 1. Brazil: Levels of complexity of product engineering activities and of technical assistance developed by the agricultural machinery industries of Rio Grande Do Sul - 1982

Activities	All Industries					Manufacturers of Power-Operated Machinery & Equipment				
	Levels of Complexity					Levels of Complexity				
	1	2	3	4	Total	1	2	3	4	Total
Research	17	53	19	11	100	20	60	15	5	100
Design	27	43	27	3	100	20	45	35	0	100
Measuring	20	47	20	13	100	20	35	35	10	100
Drawn	3	6	23	68	100	5	10	20	65	100
Test	22	36	36	6	100	45	35	5	15	100
Technical Assistance	7	50	17	27	100	0	53	12	35	100

Source: Diagnóstico do Sector de Máquinas e Implementos Agrícolas do Estado do Rio Grande do Sul - 1983.

Table 2. Complexity levels of product engineering and technical assistance activities

LEVEL	RESEARCH	DESIGN	MEASURING	DRAWING	TESTING	TECHNICAL ASSISTANCE
1	-None	-Uses patterns developed by third parties and/or traditional products	-Rudimentary measuring, without calculation	-None	-Prototype rudimentary operating tests, making other observations on units put on the market	-Technical Assistance and replacing parts supplied by the enterprise on enquire or order.
2	-Carries out no research but search for subsidies on work carried out by third parties and/or information from technical assistance	-Same as previous but making improvements on product, only with a view to its practicability	-Very simplified measuring calculation, using no technical norms	-No drawings available and parts templates are used for production	-Same as previous but carrying out prototype tests with a view to evaluate its efficiency and effectiveness (performance tests), corrections on the prototype	-Technical Assistance provided by a team of the enterprise itself on enquire or by periodical working days, the replacing parts being kept in stock at the factory
3	-Carries out sporadic research using its own personnel or Research Institute Services	-Products of its own only aiming at practicability	-Measuring calculation obtained from third parties (according to consistent criteria of its own)	-Drawings with sufficient detailing but with shortage of manufacturing information	-Prototype tests carried out in detail, in order to attain the adequate performance by correction of the prototype and project	-Technical Assistance and replacing parts supplied by dealers that keep a minimum stock of parts and have personnel of their own.
4	-Had its own structure suitable to research performance	-Products of its own aiming at practicability, aesthetics, security, ergonomics, etc.	-Measuring calculation carried out by the enterprise itself according to relevant norms, codes and criteria correct filing of calculation shets	-Complete working drawings with all necessary manufacturing information.	-Same as previous and also carrying out continuous performance tests and performance tests on the interfaces machine-soil, machine-plant, and machine-man	-Technical Assistance and replacing parts supplied by the network of dealers using personnel periodically trained at the factory.

Source: Diagnóstico do Sector de Máquinas e Implementos Agrícolas do Estado do Rio Grande do Sul - 1983.

When this analysis only refers to the industries which manufacture more complex mechanical traction machines and equipment, where a higher degree of development of the product engineering is expected, it is found that the situation is very similar to that of the industry taken as a whole.

When the analysis refers to the situation of small-sized enterprises (21-100 employees) and medium-sized enterprises (101-500 employees) which manufacture agricultural machinery and implements, and are located in Sao Paulo, the situation (figure 1) is as follows:

(a) Research

Fifty-seven per cent of the small-sized enterprises carry out no work in this field. The remainder of such enterprises, though they do not perform research work, attempt to obtain advice on work carried out by third parties or through technical assistance. In the medium-sized enterprises the situation is better, because 18.5 per cent of them perform sporadic research using their own personnel.

(b) Design

More than 50 per cent of the small-sized enterprises use models developed by third parties or traditional products, 43 per cent of them seek to improve the performance of the products developed by third parties and only 5 per cent of them have their own design with a view of practicability.

(c) Measuring instrumentation

In the small-sized enterprises a high percentage (76 per cent) carry out empirical measuring (without calculation), 22 per cent carry out simple calculations and less than 2 per cent have their own criteria at a recognized technical level.

In the medium-sized enterprises the first level is significantly reduced, while the enterprises with criteria of their own are increased to 22 per cent and nearly 6 per cent of enterprises carry out material measuring and selection according to accurate criteria.

FIGURE 1.

BRASIL: LEVEL OF COMPLEXITY OF PRODUCT ENGINEERING AND TECHNICAL ASSISTANCE IN SMALL AND MEDIUM SIZE ENTERPRISES, SOUTHEAST REGION – 1982

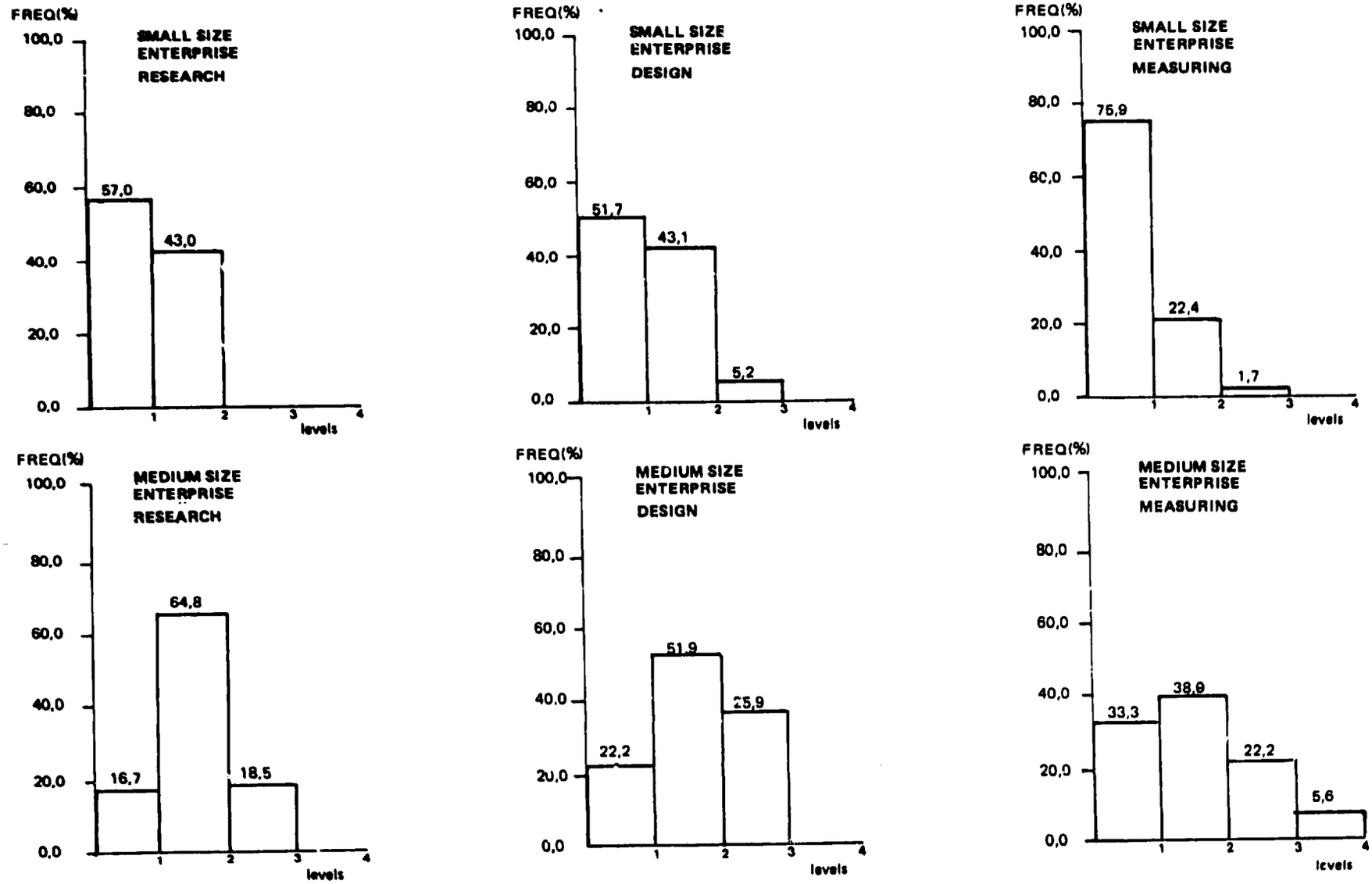
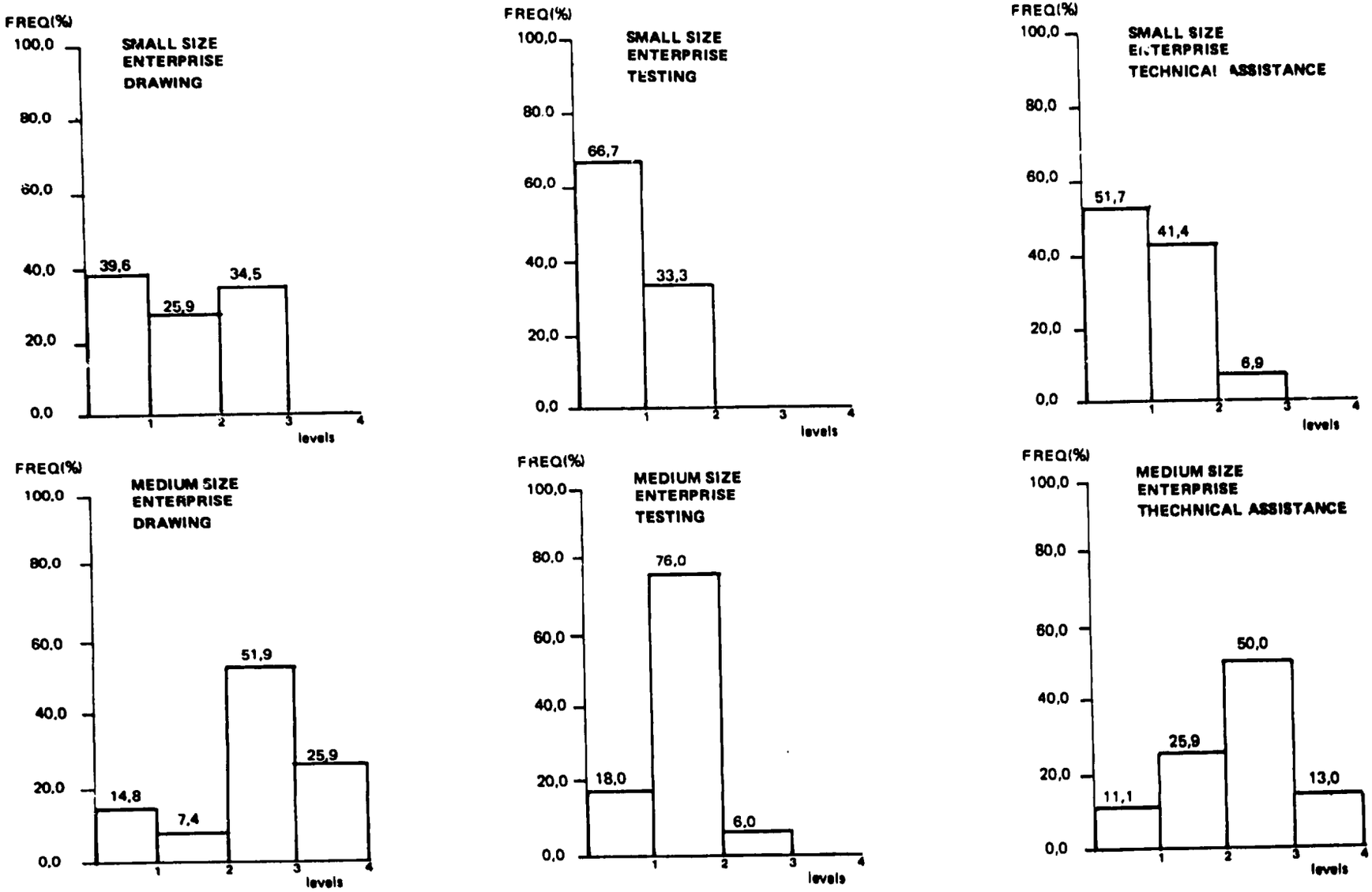


FIGURE 1.(Cont.)



Source: Universidade Federal de Uberlandia: Avaliação Tecnológica da Industria de Máquinas Agrícolas no Estado de São Paulo, Triângulo Mineiro e Sul de Goiás. 1983.

(d) Drawing

Nearly two thirds of the small-sized enterprises use no drawings or only sketches and the remainder prepares drawings with detailed information. More than 50 per cent of the medium-sized enterprises prepare detailed drawings, and the remaining enterprises either prepare complete working drawings of the assemblies and specific details or only use a sketch.

(e) Testing

Two thirds of the small-sized enterprises only carry out elementary working tests and the remaining enterprises carry out tests under actual working conditions. In the medium-sized enterprises the situation is different since more than three quarters of them carry out tests in actual working conditions, while 18 per cent only carry out elementary tests and 6 per cent of them have test laboratories and measuring equipment for testing prototypes.

(f) Technical assistance

Slightly over 50 per cent of the small-sized enterprises provide technical assistance together with replacing parts upon request but have no manuals available; 41 per cent of them provide technical assistance together with the spare parts they keep in stock at the factory; the remaining enterprises, operate through dealers that provide the technical assistance, keep spare parts in stock and have instruction manuals available. In the medium-sized enterprises the above percentages are, 11.1 per cent, 25.9 per cent and 50 per cent respectively, and the remaining enterprises provide periodical training to the dealers' personnel on how to render technical assistance.

One important aspect of the agricultural machinery and implement industry of Sao Paulo and Rio Grande do Sul refers to the continuity of technology in product engineering and technical assistance. It was found that between the industries which manufacture simple power-driven machinery and implements and those which manufacture the most advanced machines there is usually continuity

of technology, because the complexity levels at which the various product engineering operations are carried out are not affected by sudden changes, but only gradual changes occur in the complexity level upon transition from the first to the last stage.

The above means that, in principle, there is no technological barrier preventing the enterprises which manufacture relatively simple products from manufacturing the most advanced products.

However, such a possibility does not exist if the industries producing the most advanced mechanical traction machinery and implements were to manufacture tractors, automotive machines and stationary engines, since this would require going through all the product engineering operations, from low complexity levels (predominantly level 2 according to table 2) to high complexity levels.

2.2.5 Manufacturing engineering

Due to its complexity, the analysis of the manufacturing processes utilized by the industries is beyond the scope of this paper. However, since this is a crucial aspect some general operational characteristics of the industries are presented and some of the main difficulties which were found by the study of the Brazilian industry are described. These difficulties very likely prevail and are perhaps more pronounced in the other Latin American countries.

In general, the agricultural machinery and implements industry, independent of the type of its products, uses the following main production routes: cutting and bending, machining, welding, painting, inspection and testing. Casting, forging and heat treatment operations are used much less than the others.

Although the use of cast parts is relatively high, most of them are purchased from third parties. The industries which have their own foundry often supply parts to other enterprises.

Casting and heat treatment operations are used for the manufacture of a few components and employ very elementary techniques, except in some industries, for instance those which manufacture disks.

As far as the specific difficulties are concerned, the study of Sao Paulo industry states "The manufacturing process phases which showed more problems in almost all the enterprises that have been visited, were foundry, heat treatment, painting and testing and inspection. There are also difficulties in the remaining phases, but to a lower degree, and they are very much dependent upon the enterprise. Therefore, these are not systematic difficulties. Even in the cases when some manufacturing process phases show no major problems, the use of technical norms and quality control, nevertheless, indicates a level below that acceptable in all the enterprises, which constitutes a major problem."7/

During the different process phases the following problems were identified:

(a) Casting

- Low quality level of the cast parts made by the enterprises themselves (more than 50 per cent of the industries);

- Lack of skilled labour: founder, moulder-founder, stoker, master founder and laboratory technicians;

- Use of inadequate equipment. For example the use of cubilot furnace to produce modular iron;

- Use of impure materials and is used without receiving control with regard to grain size and impurity and there is no control of the moulding sand which is not properly prepared in the foundry itself.

- Inefficient control of the cast parts in general.

7/ Op. cit., page 99.

(b) Heat treatment

Almost all companies with the exception of the large-sized enterprises, make heat treatment attempts. Because the furnaces are not provided with sufficient instruments the treatment cycle cannot be performed at technically recommended times and temperatures. In case of heat treatments performed by third parties, the enterprises do not specify the values to be reached by heat treatment and they do not carry out the necessary quality control after completion.

(c) Painting

- In all kinds of enterprise, including some large-sized enterprises, the anti-corrosive protection, mainly by means of painting, is well below the technical recommendations, since the preparation of the surfaces either is not carried out at all or is carried out in an inadequate way;

- Often the recommended number of anti-corrosive primer coats is not used;

- In many enterprises painting is performed on the mounted assembly and the joints are left unpainted.

(d) Test and inspection

- As a rule, there is no control of the products purchased from third parties (components, raw materials, etc.);

- In the case of end-products, often inspection is only performed when the product is put on the market and even then it is imperfectly performed.

2.2.6 Technical support

Another important problem faced by the industries is the limited or lack of support on the part of research institutions:

(a) Identification of the types of machines and implements most suitable to the local agricultural conditions;

(b) Definition of technical norms to provide guidelines for machinery and implements manufacturing with a view to its standardization;

(c) Testing of the manufactured machines and implements ensuring the minimum operating conditions and durability.

This is especially important in countries where there is a predominance of small and medium-sized enterprises which, because of their size, cannot perform such activities.

In Brazil, such activities are developed by the Centro Nacional de Engenharia Agrícola - CENEA.

In Chile, this activity is in the early stages of development through the Departamento de Ingeniería Agricola da Universidad de Concepción.

In Colombia, the above functions are incorporated in the activities of the Instituto Colombiano Agropecuario (ICA). However, as recognized by the manufacturers the work of the Institute is limited and not much diversified.

In Costa Rica and Guatemala, such activities practically do not exist.

2.2.7 Market information

The small and medium-sized enterprises, mainly the former, are not aware of the market size, the farmers' requirements and the characteristics of the modern machines and implements manufactured in the country or imported.

The lack of diversification and repetition of products is noticed, for instance, in Chile, where 38 per cent of the industries manufacture ploughs (see table 17).

It must be pointed out, that in almost all countries the official statistics do not provide information on the national production of machines and implements, thus making it difficult to prepare estimates on the apparent consumption.

3. PROSPECTS AND POTENTIALS FOR THE MULTIPURPOSE APPROACH IN THE AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY

3.1 Characteristics of and prerequisites for the multipurpose approach

As a rule, the multipurpose approach in the industry means the use of the same production equipment to manufacture several products in small batches, in order to maximize the production capacity. Whenever feasible, the plant could also carry out further functions such as repairs, maintenance and manufacture of spare parts to increase the installed capacity utilization.

For the purpose of this study the multipurpose approach is related to small and medium-sized agricultural machinery and implements industries, so that the existing industries, with proper adaptations of the equipment, complement their production lines with new products for the agricultural sector. Where such industries do not exist, they could be established to produce batches of agricultural machinery and implements. The integration of that industry with the capital goods sector, in order to include products for other activities such as construction and transportation, widens the scope of the multipurpose approach.

3.1.1 Main characteristics

The multiproduct production approach has the following characteristics:[8/]

(a) Flexibility between product and technological process of production;

(b) The technological process of manufacture is based on universal machinery capable of different basic operations (cutting, welding, machining), in which labour plays a determining role;

(c) Production of small quantities of a great variety of products with relatively low technological complexity;

8/ UNIDO/ID/WG.400/6.

(d) The level of complexity of the products is determined at the level of production, basically by the design;

(e) The plant layout is designed to permit the production of small quantities of different products by universal machines;

(f) Horizontal integration can be achieved with the domestic technological infrastructure.

3.1.2 Basic prerequisites

The prospects for implementing the multipurpose approach depend upon the following conditions:

(a) Identification of the products likely to be manufactured according to the potential market and technological similarity;

(b) Achievement of a critical quantity or mix of products that makes the plant feasible both technically and economically;

(c) Access to raw materials and existence of related industries for the subcontracting of components;

(d) Availability of skilled labour for product development, as well as its manufacture;

(e) Product acceptance by the market;

(f) Access to the distribution channels;

(g) Availability of financial resources for investment and working capital.

3.1.3 Sectoral prerequisites

The adaptation and implementation of industries for the multipurpose approach are possible, provided that there is clear government support for the agricultural and industrial sectors involved in this approach.

A definition of an agricultural mechanization strategy is a just requirement. Since the objective of such an approach is the increased agricultural productivity through the use of machinery and implements, it is indispensable to know which machinery and implements will be used in agriculture.

If the strategy to be followed is solely directed at the development of the modern sector with the mechanization of extensive crops, this necessitates the choice of heavy mechanization and consequently the need to negotiate with transnational enterprises. Another alternative is an integrated agricultural development strategy, especially one following certain food routes, which implies a diversification of equipment.

The multipurpose approach needs the support of other industries, particularly foundry, forging, etc., as well as industries that can operate in horizontal integration by supplying components.

Such an interrelationship in the policies to be adopted in both sectors, makes the multipurpose approach a far-reaching one and therefore complex to implement. However, the lack of clear and formalized policies does not necessarily make the implementation of this type of strategy unfeasible. The important point is to be aware that the efficiency or even the economic justification is closely dependent upon the support given to the idea in terms of a sound policy.

Since such an approach is directed to small and medium-sized enterprises, the industrial policy must include financial mechanisms that enable these enterprises to implement the idea.

3.2 General restrictions

Prior to the analysis of the potentials of the multipurpose approach it is important to emphasize some general constraints that have to be considered in the evaluation of these types of strategies.

3.2.1 Size of markets

One of the most serious limitations faced by the industrialization in various countries of Latin America is the size of their domestic markets which prevents many industrial sectors from achieving economies of scale. In the agricultural machinery and implements sector the restrictions are very clear both in terms of land area now being used and the potentially usable land.

Taking, for example, the arable land for the countries being studied, FAO show the following data (in 1,000 ha): Brazil 63,000; Colombia 4,050; Chile 5,330; Guatemala 1,300; Costa Rica 283.

This restriction, particularly in the case of Costa Rica and Guatemala, becomes more obvious in an analysis of the size of market, based on the apparent consumption of agricultural machinery and implements.

By using available data - corresponding to different years - it can be estimated that, excluding tractors, the size of domestic markets, in 1984 dollars, was: about $US 10 million for Costa Rica, nearly $US 15 million for Guatemala, slightly over $US 25 million for Chile and nearly $US 35 million for Colombia (table 3).

The above figures become much more expressive when compared with the amount of $US 33 million of domestic sales of the Brazilian firm Marchesan Implementos e Máquinas Agrícolas "Tatu" S.A.

When the totals for the domestic market of each one of these countries are disaggregated at the level of various machines and implements, it can be seen that the specific demand is in many cases extremely small. For example, in Chile the annual market for replacing very important items such as

Table 3. Apparent consumption of agricultural machinery and implements in selected countries

	Consumption of Tractors 1980 (units)		Apparent consumption of agricultural machines and implements (US$ thousand)								
	Imports	Internal Production	Year	Production	+	Imports	-	Exports	=	Total	Total Excluding Tractors
Brazil	-	50,994	1980	1,672,372	+	14,662	-	145,008	=	1,542,026	857,970
Chile	1,312	-	1980	...		35,600	-	328	=	35,272	20,051
Colombia	1,201	-	1982	19,745	+	65,380	-	5,355	=	79,770	31,244
Guatemala	500(*)	-	1979	1,120	+	20,449	-	1,254	=	20,316	9,700
Costa Rica	188	-	1984	1,306	+	13,200(*)	-	150(*)	=	14,656	9,200

Source: Brazil: IBGE, Censo Industrial, 1980; CACEX, Anuário de Comércio Exterior
Chile: Banco Central de Chile; Colombia: DANE; Guatemala: Banco de Guatemala; Costa Rica: Banco Central de Costa Rica.

* Estimate.

ploughs (tractor driven) and harrows reached about 1,000 units each. In the case of Guatemala such figures are much smaller, about 350 ploughs (tractor driven) and the same number of harrows.

These limited quantities represent a serious obstacle for the production, even by multiproduct units, at levels that allow economies of scale. This restriction is especially valid when the demand is met by imports and various manufacturers.

3.2.2 Foreign trade policies

A further fact which plays a strategic role in the industrialization is the policy adopted with regard to import of foreign products.

The countries under study have clearly different policies. On the one hand there is Brazil with very high import duties and tax on industrial products (IPI) and on the other there are the Central American countries with almost symbolic taxes. Between these two extremes lie Colombia and Chile, the latter with less protection.

Tariff rates together with the exchange rate policy may have important impacts on the agricultural production cost and thereby affect the agricultural prices in the domestic market as well as competition in the foreign markets. These instruments therefore, have a crucial influence either encouraging or discouraging industrialization.

In the case of countries and products which are the subject of this study (see table 4) Brazil has adopted a policy for the protection of the agricultural machinery and implements industry. It was on the basis of such policy that the industry was implemented and developed. An important fact is that the tariff protection is very high in simple technology products such as hand tools on which a 70 per cent ad-valorem tax was levied.

In the case of the tractor and combine harvester industries, which have been operating for fifteen years and reached high production levels a 30 per cent ad-valorem protection applies.

Table 4. Import duties: Brazil, Chile, Colombia, Costa Rica and Gautemala - 1985

BTN	NAUCA	PRODUCTS	BRAZIL	CHILE	COLOMBIA [a]	COSTA RICA AND GUATEMALA
82.01	694-12-01	Hand-Tools	Ad-Valorem: 70%, excep curved machetes (30%), scythes & sickles (55%) and rakes, forks, pitch-forks (55%) IPI =	Ad-valorem: 10%	Ad-valorem: 58% excep machetes (74%) and hedge shears (40%) IVA = 10%	Ad-valorem: Machetes (20%). Hoes, Axes, Picks, etc. (8%)* tools with handle** and other (15% * also pay US$0,15 by kg. ** also pay US$0,25 by kg.
84.24	712-01	Agricultural machinery for soil preparation	Ad-Valorem: 45%, excep 3 items (30%) IPI = 5%	Ad-valorem: 10%	Ad-valorem: 33% excep items for cultivating (3%) IVA = 10%	Ad-valorem: 5%
84.25	712-02	Harvesting and threshing machinery	Ad-valorem: 45% excep. combine harvester thresher (30%), lawn mowers (55%) egg-graders (30%) IPI = 5%	Ad-valorem: 10%	Ad-valorem: mostly 3% excep some items between 9% and 41% IVA = 10%	Ad-valorem: 5%
84.26	712-03	Dairy machinery	Ad-valorem: 45% IPI = 5%	Ad-valorem: 10%	Ad-valorem: Milking machines and parts (3%), other (9%) IVA = 10%	Ad-valorem: -
84.27		Presses, crushers and other machinery	Ad-valorem: 45% IPI = 5%	Ad-valorem: 10%	Ad-valorem: 50%, excep parts (33%) IVA = 10%	Ad-valorem: -
84.23	712-09	Poultry-keeping and bee-keeping machinery, etc.	Ad-valorem: 30% excep 2 items IPI = 5%	Ad-valorem: 10%	Ad-valorem: 33% excep incubators (9%), bee-keeping machines (9%) and straw crushing machines (9%) IVA = 10%	Ad-valorem: 10%, excep manual grain mills and Poultry feeders
87.01	713-01	Tractors	Ad-valorem: 30% IPI =	Ad-valorem: 10%	Ad-valorem: 3%, excep tracked tractors (3%) IVA = 10%	Ad-valorem: 7%

Source: Tarifa Aduaneira.

(a) All products require previous license.

Chile, after having had very high tarifts during several decades opted for a uniform 10 per cent ad-valorem tariff consistent with the market economy which was implemented in the second half of the 1970s. In recent years, a 30 per cent ad-valorem tariff has been established for all products, which represents a certain protection for the industry. However, as from July 1985, this flat tariff was reduced to 20 per cent.

In Colombia, there is more diversification in the tariffs. In the case of hand tools more protection is provided for the domestic industry: a 58 per cent import duty on most items and 74 per cent on matchets. It must be stressed that for products with no potential for the national industry, such as tractors and harvesters and threshers, the tariffs are symbolic (3 per cent). It should be mentioned that as from 1985, by force of Law no. 50, a 10 per cent tax on value added (IVA) was extended to the imports of machinery and capital goods. In addition to the taxes, the previous license system makes the import process slower.

In the Central American countries, the ad-valorem tariffs are extremely low and in certain cases there are none. The most significant group of products, i.e. hand tools, is given much less protection than in the remaining countries under study. In Central American countries no tariff incentive exists for the establishment of these industries.

3.2.3 The industrial context

The development potential for the agricultural machinery and implement industry is closely connected with the level attained by the manufacturing industry and more specifically by the metalworking industry.

In other words, the supply of raw materials, components and parts, as well as subcontracts are so interconnected that they require existing related industries on such a development level as not to represent a bottleneck for the machinery and implements industry.

The identification of the related industries and evaluation of their development level is a complex task beyond the scope of this study. Thus, the relative shares in manufacturing of the engineering and metalworking industries in the countries under discussion are taken as an indicator of this.

As shown in table 5, the shares of engineering and metalworking industry in manufacturing has reached very low levels, i.e. 11 per cent or less in more than half of the countries of Central and South America. It should be stressed that 11 per cent is less than half the average value achieved by the group Argentina-Brazil-Mexico.

Similar conclusions can be drawn when analyzing the per capita production of the manufacturing industry and mainly the metallurgical and mechanical branches.

These figures reflect the little development achieved in many countries by the above sectors and they suggest the constraints faced during the establishment and expansion of the agricultural machinery and implements industry.

3.3 Present situation vis-à-vis the multipurpose approach

3.3.1 Present characteristics of industries

Size

The enterprises are predominantly small and medium-sized. However, it is important to emphasize that the concepts of small and medium-sized firms, with respect to number of employees are not the same in all countries; these differences are marked when other complementary variables are used, such as capital and sales.

Except for some very special cases, it is very difficult to include the small-sized enterprises and a high percentage of medium-sized enterprises in the potential for the multipurpose approach. The restrictions are of various kinds: administrative, commercial, technological, etc. Furthermore, it is

Table 5. Latin America: Level of development in manufacturing

Countries	Share of Manufacturing in the G.D.P.	Share of Metallurgical and Mechanical Branches in		Product per capita 1983 (US$1982)	
	1982(a)	Manufacturing 1980	G.D.P.	Manufacturing	Metallurgical & Mechanical Branches (b)
Argentina	22.3	27.6	6.8	462	128
Brazil	27.1	22.4	6.5	414	93
Mexico	23.3	17.	4.3	509	91
Chile	19.1	18.3	4.1	318	58
Uruguay	19.8	...	...	434	..
Colombia	16.0	16.0	2.7	210	34
Peru	19.1	14.2	2.9	214	30
Venezuela	15.9	13.4	2.3	494	66
Ecuador	21.4	4	1.0	217	10
Bolivia	14.3	4.1	0.7	74	3
Paraguay	15.7	2.8	0.5	204	6
Panamá	9.5	5.7	0.6	196	11
Costa Rica	17.7	10.0	1.8	300	30
Honduras	14.4	4.2	0.6	106	4
Nicaragu	18.5	...	...	255	..
Guatemala	14.7	9.5	1.5	194	18
El Salvador	15.0	7.5	1.2	104	8

Source: Anuario de la CEPAL

(a) At constant 1970 prices
(b) Estimate based on share corresponding to 1980.

very likely that the medium-sized companies whose labour force is close to that of the large-sized enterprises (50 employees), are those with the highest capacity for adaptation.

Production pace

The majority of small and medium-sized enterprises neither operate under continuous production nor in batches, but only to meet their clients' orders. This is due to the limited size of their market, the irregular demand flow, specificity of some orders, shortage of capital to keep the production in stock, etc.

Level of diversification

Generally speaking, regardless of the size of the enterprises, a reduced production diversification and repetition of the same products is observed in all countries. For examples, in Chile only 50 per cent of the industries manufacture more than 5 products and in many cases the diversification is almost nominal, since it is restricted to variations of the same product, which occurs with various types of farm wagons.

Such lack of diversification is in part a result of the shortage of information about the market. In other words, the industries have difficulty in identifying new products.

Production process

A similar situation exists among the small and medium-sized enterprises in various countries, because of the predominance of cutting, bending, welding, machining and assembly activities. This, in principle, would be favourable for a multipurpose approach since it suggests a certain equipment versatility.

Capacity utilization

In all countries and in enterprises of all sizes, the level of capacity utilization is as a rule less than 70 per cent, and in some cases it reaches only 50 per cent. However, these levels are higher than those of the last 3 years, which in some cases such as Parada sprayers industry in Chile, reached 20 per cent in 1982. There would, therefore, be room to include new products.

Maintenance and repair

The small and medium-sized enterprises perform this type of activity not only for machinery and implements manufactured by them, but also for equipment other than agricultural. In this area the sales of spare parts and the manufacture of parts should be included. These activities, which are part of the technical assistance, have reached a relatively high share in the enterprises' income in the last few years, because of the longer life of machinery and implements.

Interrelated industries

All countries have foundry facilities, forging and mechanical, and metalworking industries with a good technological level. The problem is their limited capacity to meet the requests of the various industries within a short time. The levels of technological requirements are not very strict, and this makes the evaluation of the enterprises with respect to such industries questionable.

3.3.2 Sector definitions

In general the situation in this area in the various countries is not favourable for the implementation of the multipurpose approach due to the lack of a sound policy for agricultural mechanization.

In Brazil, the work carried out by Empresa Brasileira de Pesquisa Agropecuária-EMBRAPA, a government agency, is an example in this field. EMBRAPA has researched and adapted the polycultor, an animal drawn implement developed by Societé Mouzon in France. EMBRAPA displayed it for two years throughout the country and later the manufacture of this equipment was started by CEMAG Industry in the North-East.

This government agency not only showed interest in a particular type of mechanization, but it also had the initiative of choosing the equipment, displaying it to the potential markets and providing the financing necessary to start its manufacture.

A similar example also exists in Chile. Taking into account that 86 per cent of the farms have less than 50 ha and represent 56 per cent of the agricultural area in the country, the government has worked out a plan to help the development of small farmers. The Plan Nacional de Fomento Equino para la Agricultura is aimed at:

(a) Increasing the reserve of draft horses for agricultural labour;

(b) Introducing the appropriate technology to meet the needs of the small and medium-sized agricultural enterprises in respect of advanced-design animal traction equipment and implements.

In order to develop the above plan the Government imported horses for stud and studied and selected prototypes of farming implements abroad for later adaptation to the country's conditions. The adapted farming implements are already being manufactured in the country.

However, the plan has a wider scope since it anticipates for the next steps:

(a) The establishment of testing centres for animal traction equipment and implements taking advantage of the infrastructure existing in the country (Instituto Nacional de Investigaciones Agropecuarias (INIA) and Universidad de Concepción);

(b) Promotion of and incentive to the manufacture of animal draft agricultural equipment and implements that demonstrate their technical feasibility at the research centres where they are tested;

(c) Access to these research results by the engineering and metalworking sector and/or potential investors;

(d) Technical and market studies in order to determine the present and future needs for the equipment and implements, thereby providing the national industry with guidelines concerning the different types of equipment required by the country for its different crops and the most important agricultural activities.

In the case of Colombia, the Government policies towards agricultural mechanization seem to have been more informal. In principle, the Ministry of Agriculture and the institutions connected therewith, such as to Instituto Colombiano Agropecuario (ICA), among other aspects have to study the mechanization suitable to the crops and regions where they are grown. However, for various reasons, it does not seem that more far-reaching steps have been taken in this area.

No special policy exists for another important variable, i.e. the financial support for the expansion or implementation of small and medium-sized agricultural machinery and implement industries in general. The policies and incentives are usually related to the manufacturing industry or the capital goods sector taken as a whole.

In Chile, for instance, there is a programme, through the Servicio de Cooperación Técnica, for the small-sized industry and crafts workshops to use resources from Fundo CORFO-BID. In the pericd 1983/1984 the resources amounted to $US 230 million and for 1985 the amount is $US 150 million. The financing referred to, which is subsidized, also includes the small-sized agricultural machinery and implement industries and has the following characteristics:

Financing of up to 75 per cent of investment requirements, intended for the purchase of new domestic or imported machinery, plant construction and purchase of raw materials and tangible inputs. The maximum and minimum limits are equivalent to $US 32,000 and $US 1,600, respectively. The terms depend upon the project evaluation, however, the limit term is 8 years with a 2 year grace period. Interest is 6 per cent per year plus 1 per cent commission and the readjustment is according to Unidad de Fomento (U.F.). The guarantee should correspond to at least 30 per cent of the credit value.

CORFO also provides the same type of subsidized financing for medium and large-sized industries. However, it must be stressed that, according to some manufacturers, access to such financing is very difficult due to limited resources.

In Guatemala there are no special incentives for new industries. The only support that exists is the total exemption from import duties of equipment. A few years ago the Corporación Financiera Nacional (CORFINA) used to finance from the preliminary studies up to implementation. However, no concrete results were reached.

3.4 Potentials

Here two important considerations are presented viz. the economic condition of the countries and the industries' attitude towards the introduction of the multipurpose approach.

3.4.1 Favourable economic conditions

As compared with the period 1980 to 1983 the economies of the various countries showed positive growth rates in 1984 both in overall terms and in the livestock and farming sector. The estimates for 1985 are that this trend will continue. As a result of the difficulties in their balance of payments the countries have severely restricted imports in the last few years.

In the agricultural machinery and implements sector the reductions of imports were drastic in all countries.

In some countries this situation, aggravated by the strong devaluations of the currency, stimulated a process of import substitution allowing the creation of new industries. In Chile, for instance, the Gildemeister enterprise, the most significant importers and dealers and a John Deere's representative, decided to start the manufacture of chisel ploughs and disc harrows. The firm estimates that the plough now imported, if produced in the country, would cost only 60 per cent despite the small scale.

In Guatemala Talleres Fuentes has increased the range of products manufactured, because at present the cost is somewhere between one third and one half the price of the imported product.

In Costa Rica the Carazo industry has noticed that the orders for manufacture of parts and components are increasing considerably, especially for the sugar mills, as a result of the foreign exchange problem. To sum up, the adopted policy is stimulating the creation and expansion of various industries to substitute imports.

3.4.2 Attitude of manufacturers to the multipurpose approach

Present application

A high percentage of enterprises, particularly the small-sized ones are versatile workshops and repairshops engaged in industrial activities such as those of the agricultural machinery and implements sector. However, such a versatility does not correspond to the multipurpose idea, because of the following factors: the production is not in batches, but against orders; it does not refer to specific products; the firms have neither plants nor equipment especially geared to these activities; usually they are not efficient and are working with idle capacity.

Nevertheless, there are some examples, as in the case of AARCO in Guatemala, which to a large extent fits the multipurpose approach concept. Other cases would be:

(a) In Chile, ICAT, which is starting the manufacture of the multicultor comprising more than twelve components, is also to a certain extent geared to the multipurpose approach;

(b) In Brazil, CEMAG, in spite of being a large-sized enterprise (it has over 400 employees) is also following in part the multipurpose approach.

It is necessary to add that many enterprises, although they have not adopted the multipurpose approach, have made efforts to complement the main production line by incorporating new products, both to increase the capacity utilization and recover from stagnation. Some examples in Chile are Metalúrgica Sudamericana which complements its production of disks by manufacturing hammer mills, shovels, steel knives for ploughs, etc. and SOGECO which manufactures implements for construction in order to recover from stagnation.

Preference for specialization

In the enterprises' opinion the multipurpose approach idea, although theoretically valid, is complex in practice, because of various restrictions:

(a) The higher the diversification the less efficient is the manufacture of each product;

(b) The product markets are different and have their own characteristics;

(c) Components and parts are often different for each product requiring several suppliers;

(d) It is difficult to plan ahead for the various products, because the market is very small;

(e) First it is necessary to gain experience and be successful with certain implements before extending the range;

(f) The specialization through economies of scale and personnel specialization results in greater advantages;

(g) Because of the risk of overproduction, new products must be developed;

(h) The distribution of some products is often done through different channels thus making the sale of the entire range difficult;

(i) The product technologies, even if similar in some cases, have their inherent complications.

The restrictions listed above as well as others can be grouped as follows: lack of information about the market, product distribution problems, administrative problems, a preference for gradual expansion.

4. MAIN FINDINGS AND RECOMMENDATIONS

4.1 Scope of the multipurpose approach

The multipurpose approach can contribute to the solution of an important problem: the inability of some patterns of specialized industrial production to satisfy the diversified requirements of farmers and to make the manufacturing units profitable.[9/]

In the case of Latin American countries, as in other developing countries, the deficiencies in the agricultural machinery industry are due to several technical and economic factors, in particular the rigidity of the production process and its inability to adapt to the changes and to the small size of the market, the insufficient adaptation of the complexity of the products and processes to the prevailing conditions and resource endowments of the countries. However, the multipurpose approach is neither universal nor uniform, nor without limitation. The necessity and practical modalities of the approach varied greatly with the existing conditions in each country, in particular with respect to the sizes of the markets and the existing technological and industrial levels.

The multipurpose approach to the manufacture of agricultural machinery and related capital goods can be seen within the following framework:[10/]

(a) A multipurpose agricultural machinery plant is an enterprise which produces various products and services in the field of agricultural machinery, rural development and other related capital goods, embracing the areas of product adaptation, design and development, manufacturing, marketing, after-sales service, repair and maintenance;

9/ For further details see, UNIDO, Report of the Expert Group Meeting on the development of multipurpose agricultural machinery plants, Guangzhou, People's Republic of China, 13-18 November 1984. ID/WG.449/4.

10/ UNIDO, ibid p.6.

(b) The activities should be geared mainly towards satisfying the needs of the farmers and the modernization of the rural sector;

(c) The manpower, equipment and manufacturing processes should be flexible enough to permit adjustment to the varying market demands, and to the existing national/local technological capabilities;

(d) There should be a strong coherence between the choice of the markets/products and the manufacturing processes and equipment so as to ensure that the best and most profitable use is made of the available equipment and manpower. Each machine should be used beyond the minimum work load (measured in terms of hours of use or volume of production) in order to ensure a reasonable productivity of machine and personnel and to cover indirect costs involved;

(e) Multipurpose production will contribute to raising the technological level of the manpower (training function).

The fulfilment of the above-mentioned requirements implies at the same time the awareness of problems to be solved before a final adoption of the approach is made. For example:11/

(a) It is essential that multipurpose plants be designed, operated and developed according to rational and precise rules. In particular, the strategy of the enterprise should be developed around certain common dominant and homogeneous characteristics which are mainly related to the available process and equipment, to the know-how and skills of manpower and to the market.

11/ UNIDO, ID/WG.449/4, p.7.

(b) Product development constitutes a central problem and involves various agents of the industrial and agricultural national system. In most cases, some design capabilities are necessary in the plant itself. The critical issue, however, is the analysis of the needs and the satisfaction of the specific requirements of the users, i.e. detailed analysis in a dynamic environment.

(c) Multipurpose agricultural machinery plants can play an active role in the strengthening and/or establishment of specialized manufacturing capacities, i.e. by means of sub-contracting, when the conditions are met for a large-scale production of certain products. They have a high potential for contributing to the overall development of engineering and capital goods industries.

(d) The promotion of multipurpose agricultural machinery plants needs strong support from the national authorities, in particular at the beginning of their operation, in order to overcome some general and also some specific constraints, especially as regards the availability of raw materials, design of products, training and financing.

4.2 Main factors affecting the introduction of a multipurpose approach in Latin America

The agricultural machinery sector should be considered in its wider sense and therefore include the various metal products and engineering equipment needed by the agricultural activities. The multipurpose agricultural machinery plants, while meeting the various priority needs for engineering products of the agricultural sector, should contribute to the process of industrialization through the use of local resources and manpower, as well as the acquisition and mastery of efficient and adapted technology. In order to be acceptable, therefore, the multipurpose agricultural machinery plants should be suitable for the production of agricultural machinery and implements in particular and capital goods in general.

However, most of the agricultural machinery industries in the small and medium enterprises in some Latin American countries have developed on the basis of collective workshops or blacksmith shops (Costa Rica, Guatemala). It is easy to understand that the layouts of some of these plants are unproductive and uneconomical because of the lack of capabilities at the stage of drafting and design. This can be seen as a drawback for the layout of a multipurpose plant.

The analysis of the enterprises in Latin America also showed that although manufacturing capacities exist, they operate at a very low capacity utilization rate and face many structural difficulties. Therefore, the prevailing agricultural crisis and the low price level of agricultural commodities definitely affect the purchasing power of farmers and depress the market for agricultural machinery. The large plants designed for the mass production of one product have failed to adapt the production processing to the changing conditions of the demand in terms of variety and quality. In such conditions, the multipurpose plant is necessary to meet the diversified requirements of farmers and related agricultural activities, under the condition of increasing capacity utilization, through up-grading and expansion of the agricultural machinery plant itself.

In Latin America, moreover, the agricultural machinery industry depends on a balance between imports and domestic manufacturing, ensuring a complete range of equipment to meet the needs of the countries. Local manufacturers need, at the same time, supplies of raw materials, credit, technical advice, and assistance in developing local engineering designs.

An agricultural machinery industry, dependent on a domestic market, can only exist if farmers can obtain adequate yields and if they receive an adequate return for their crops, i.e. agricultural production in the area must itself be profitable and dynamic. If agriculture is static in volume and methods then the only market for agricultural machinery is in the replacement of existing implements and since in peasant cultivation in some Central American countries as well as in Colombia most tools are simple and of low cost the prospect of developing a viable multipurpose approach in the sector is low.

4.3 Possibilities to introduce the multipurpose agricultural machinery plants in small and medium scale enterprises in Latin America.

4.3.1 General considerations

The introduction of the multipurpose approach in the small and medium scale enterprises in Latin America means a change in production processes and technology, considering the following requirements:

(a) The small and medium manufacturers should produce implements and equipment suited to the local conditions and for which a market exists or can be developed;

(b) Materials and spare parts must be available, of adequate quality and regular supply ensured;

(c) Foreign exchange must be available for import of materials and spare parts required for the production processes;

(d) Skilled labour must be available;

(e) Energy supplies must be reliable and of reasonable cost;

(f) Unless credit is available the farmer may be unable to purchase equipment even if convinced of its advantages, and

(g) Extensive training and advice on the correct operation of their equipment must be given in order that they may use it efficiently and profitably.

The structural constraints that have limited the development of the small and medium agricultural machinery enterprises in Latin America can be overcome, if the following components are clearly analyzed and concrete actions can be established.

(a) Research and development into farm power needs, inventory of existing implements, machinery and equipment, its adaptation, improvement, new developments and testing;

(b) Agricultural machinery planning and management, as well as provision of selected agricultural machinery services (manufacture, maintenance and repair operations) through public or government sector;

(c) Formulation of a policy of selected small holder agricultural machinery packages; and

(d) Institutional support measures, pricing policies (taxes and subsidies), credit, training and extension, workshop.

This exercise, however, requires the formulation of a concrete policy at country level to promote the agricultural machinery sector, which should therefore proceed focussing on four points:

(a) Outline the broad economic forces that determine the type of agricultural machinery and implements produced and used in the countries, their price and quality and the nature of the interactions between the farm equipment production and the development of the agricultural sector;

(b) Examine in concrete terms how agricultural machinery production has been adapted, can be adapted or fails to be adapted, to the needs of the typical farmer in the countries;

(c) Analyze the different impacts of the agricultural machinery industry on output, employment and foreign exchange requirements depending upon the agricultural mechanization strategy that is pursued by the countries; and

(d) Focus on the organization of the medium and small scale industries and its relationship to the international and regional co-operation.

After such a policy has been adopted it is necessary to consider in which stage the multipurpose approach can be formulated as an alternative to increase the output of the sector. This requires a diagnosis of the available facilities and a stocktaking of the small and medium engineering industries existing in the manufacturing sector. The following factors can be closely considered:[12/]

(a) Specific and precise guidelines for the estalishment of new multipurpose activities in existing engineering industries;

(b) Precise guidelines to rehabilitate and expand the small and medium scale enterprises that are already operational;

(c) A correct overview in cases when it is necessary to study and promote several multipurpose plants as part of an industrialization plant; and

(d) A precise approach to make a diagnosis of multipurpose enterprises and to correct any operational deffects.

4.3.2 Technical co-operation from Brazil

Among the potential transferers of technology under the South-South scheme in Latin America, Brazil may be the country best suited to supply some kind of technical assistance. Actually, it is already engaged in this form of international co-operation through the so-called CTPD-Programa de Cooperacao Técnica entre Países em Desenvolvimento (Technical Co-operation among Developing Countries), which is part of the "Brazilian foreign policy towards the strengthening of the South-South dialogue".[13/] Some of the characteristics of this programme are given in table 6.

12/ UNIDO, Conceptual framework and aspects of multipurpose production of engineering and agricultural machinery products: Some proposals by UNIDO. ID/WG.449/1, p.19.

13/ SEPLAN - SUBIN, Secretaria de Cooperacao Economica e Técnica Internacional, Programa CTPD. Relatório de Atividades, 1983, p.1.

Table 6. Brazil CTPD programme on technical co-operation among developing countries - allocation of funds, shares by regions, 1981-1983

	1981	1982	1983
Allocation of funds ($US thousand)	1,977	4,055	1,909
Distribution by region Latin America (%)	67.3	71.7	61.9
Atrica (%)	24.5	12.9	10.3
Latin America and Africa (%)	8.2	15.4	27.8

In relation to the above, it is important to observe that:

(a) In most cases, the allocated resources demand from the Brazilian agencies responsible for the execution of the programmes a contribution of approximately the same amount; this means that the total resources are almost twice those shown in table 6;

(b) In 1983, the agricultural and industrial sectors that are linked to the technology transfer for the multipurpose approach accounted for 9.3 per cent and 15 per cent of the total funds, respectively, whereas the number of trained personnel reached 30 in the agricultural sector and 122 in the industrial sector.

A recent study of the Brazilian technical co-operation[14/] identified the following goals for projects developed in the period 1980-1983:

- Training of human resources 54.0 per cent
- Dissemination of Brazilian techniques, technology and experience (e.g. alcohol, wood, etc.) 34.7 per cent

14/ FUNCEX, Fundacao Centro de Comércio Exterior. Estudo do Sistema Interministerial de Cooperacao Técnica, 1985.

- Material infrastructure work 6.3 per cent
- Identification of business opportunities 3.5 per cent
- Other 1.5 per cent

The mere observation of these percentages show that the Brazilian technical assistance activities mostly concentrated on programmes that require small investments. This is the case in human resources training, as compared with the creation of infrastructure that demand great capital expenditures.15/

All considerations presented so far lead to the conclusion that the South-South co-operation has evident limitations on the part of possible suppliers or countries which transfer technical assistance and expertise. Thus, it should be considered only as a complement of a North-South basic co-operation.

15/ FUNCEX, op.cit., p.14.

5. THE LATIN AMERICAN AGRICULTURAL MACHINERY AND IMPLEMENTS INDUSTRY

This chapter, presents the overall situation of the above-mentioned industry in the following countries: Brazil, Chile, Colombia, Costa Rica and Guatemala. These countries are representative, since they reflect, to a certain extent, the various levels of development reached by the industry in the region.

The depth of the analysis differs from one country to another, depending on the amount of information gathered in each case.

5.1 Brazil

5.1.1 The industry, its size and characteristics

This sector is difficult to define as its activities are partly merged with those of the metallurgic, metalworking and automotive sectors. However, it is possible to estimate, based on the data provided by the Industrial Census of 1980, that the total number of plants engaged in this activity (hand tools are excepted) was approximately 600, employing over 30 thousand people, with a gross production value of almost $US 1.7 billion. It should be noted that the tractor industry accounts for 46 per cent of this gross production value.

A more reliable estimate about the number of establishment is provided by the 340 member firms of the ABIMAQ - Associacao Brasileira de Industria de Máquinas e Implementos Agrícolas. According to that association, they account for 92 per cent of the total of Brazilian production.

The production of implements is a segment of the industry comprising mostly small or medium-sized firms of predominantly Brazilian capital,[16/]

16/ The classification of small and medium-sized industries in Brazil includes, among other factors, a greater number of employees than used in UNIDO reports.

whereas the machine industry consists of large or medium-sized firms with a significant participation of foreign capital.

As regards the production of agricultural handtools, no specific information is available, since the majority of factories produce both agricultural and non-agricultural tools. It should be mentioned, however, that the Industrial Census of 1980 shows 514 firms engaged in the production of handtools. These employed over 15,000 people, and reached a gross production value of US$ 263 million. One way of evaluating the relative importance of the agricultural machinery and implements industry (with the exception of tractors) is through a comparative study of the metalworking industry as a whole. This shows that its share is 5.9 per cent of the number of plants, 5.1 per cent of the labour force and 6.5 per cent of the production value.

As shown in table 7 the average productivity in 1980 reached almost $US 33,000 per employee in the machinery and implements sector as a whole, against $US 74,000 for the tractor sector alone.

The share of value added in the overall production value, reaches 45 per cent in the first sector against 34 per cent in the case of the tractors.

This industry has a rather high degree of national content, the share of imported components in the production value is only about 3.8 per cent for tractors and 2 per cent for harvesters. These percentages are government controlled, through the Conselho de Desenvolvimento Industrial (CDI). However, foreign capital plays an important role either by means of partnerships with Brazilian firms or complete control.

5.1.2 Development of the industry

The development of the agricultural machinery and implements industry as well as the pace of agricultural mechanization in Brazil, are closely related to the establishment of the tractor industry, which began operating in 1960,

Table 7. Brazil: Industry of agricultural machinery and implements - 1980

Activities	Enterprises		Employees		Salaries	Value of production		Value added	(4)/(2)	(3)/(2)	(5)/(4)
	Unit	per cent	number	per cent	$1,000	$1,000	per cent	$1,000	ratio	ratio	ratio
Agricultural Machinery and Implements	216	37.2	11,710	42.6	36,528	443,074	49.3	167,400	37.8	3.1	0.38
Sprayers	25	4.3	1,929	7.0	8,178	73,207	8.2	42,979	38.0	4.2	0.59
Agricultural, Horticultural, Poultry-keeping and Bee-keeping Machinery	56	9.7	2,274	8.3	5,977	64,782	7.2	30,664	28.5	2.6	0.47
Machinery N.E.C.	114	19.7	3,910	14.2	12,125	123,397	13.7	59,450	31.6	3.1	0.48
Processing Machinery	77	13.3	2,985	10.9	8,065	72,106	8.0	42,163	24.2	2.7	0.58
Parts and Accessories	92	15.8	4,655	17.0	14,497	121,898	13.6	61,841	28.2	3.1	0.51
Sub-total	580	100.0	27,463	100.0	85,370	898,464	100.0	404,497	32.7	3.1	0.45
Tractors	17		3,560		17,533	773,852		262,220	73.7	4.9	0.34
TOTAL	597		31,023		102,903	1,672,316		666,717			

Source: Censo Industrial 1980. IBGE.

Table 8. Brazil: Production, imports and exports of tractors and harvesters, 1965-1984

Year	Tractors a/			Harvesters		
	Production	Imports	Exports	Production	Imports	Exports
1965	8,121	374	-	-	61	-
1966	9,060	639	6	12	80	-
1967	6,223	342	31	28	392	-
1968	9,671	990	7	84	780	-
1969	9,547	423	7	282	1,039	-
1970	14,048	60	41	750	1,646	-
1971	22,122	184	104	1,150	2,087	-
1972	30,207	228	188	1,921	1,014	4
1973	39,232	258	386	3,506	1,096	25
1974	46,848	347	895	4,993	2,601	96
1975	59,166	801	649	7,323	2,570	223
1976	65,327	191	472	7,289	521	129
1977	52,966	39	4,584	5,054	148	240
1978	48,675	-	6,134	4,298	6	132
1979	55,247	-	7,263	4,663	-	246
1980	58,812	-	7,743	6,601	-	311
1981	39,341	-	10,073	5,049	-	345
1982	30,346	-	6,239	5,545	-	127
1983	22,612			3,573		
1984	45,907			6,199		

a/ Four-wheeled tractors.

Source: Associaçao Nacional de Fabricantes de Veiculos Automotrizes ANFAVEA.

Associaçao Brasileira da Indústria de Máquinas e Equipamentos ABIMAQ.

and the production of harvesters, which started in 1966 (see table 8). The establishment of both industrial sectors was a result of a deliberate policy of import substitution. Its creation and expansion received generous official incentives to domestically produced articles: Lei do Similar Nacional, tax and foreign exchange exemptions for installing these industries. At the same time, the demand was stimulated by subsidized agricultural credit for the purchase of machinery and export promotion.

Those incentives, a typical example of infant industry protection, were justified on grounds of a pressing need of capital and technology to take advantage of economies of scale, with the resulting decline of the real price.

As far as the development of the agricultural machinery and implements industry (tractors excluded) is concerned a sharp increase was observed between 1970 and 1975, followed by relative stability in the five succeeding years (table 9).

Information referring to more recent periods (from 1980 onwards) is found in the ABIMAQ statistics. The per cent changes of the main variables are shown in table 10. In the period from 1980 to 1983 there was a decline of one third in the production value. In 1984, however, a recovery was made, and statistics for the first semester of 1985 indicate a continuation of this trend, although at a slower pace.

In 1984 tractor sales rose sharply by almost 95 per cent to more than 50,000 units; 90 per cent of these were destined for the domestic market. Tractor exports in that year, increased by about two thirds.

Table 9. Profile of the agricultural machinery and implements industry (other than tractors), Brazil 1970, 1975, 1980

Year	Number of establishments	Number of employees	Production value $US million
1970	365	14,300	95.7
1975	552	28,500	696.3
1980	580	27,500	898.5

Source: Censos Industrias - IBGE

Table 10. Profile of the agricultural machinery and implements industry (other than tractors), changes (per cent) Brazil, 1980-1984

	1980	1981	1982	1983	1984
Employment	9.0	2.5	-10.6	-17.9	16.6
Production value	14.9	-2.7	-14.6	-12.9	27.3

Source: ABIMAR

The recovery of the domestic market was due partly to the higher income level of farmers resulting from more profitable minimum prices for agricultural products, and partly to the need to replace obsolete equipment.

5.1.3 Composition of production

The Brazilian agricultural machinery and equipment industry is highly diversified, both in terms of providing for farming needs and the amount of manufactured products. As shown in table 11 this industry caters to all phases of the farming activity. Almost 60 per cent of the total sales, however, are products for harvesting and soil preparation.

The great diversification of the industry, especially in items for soil preparation, is shown in table 12, where it can be seen that:

(a) A set of 34 products accounted for about 80 per cent of the value of sales in the past nine years;

(b) With the exception of self-propelled combine harvesters, all other products under consideration have only a minor share.

Table 11. Brazil: Value of sales of agricultural machinery and implements - 1975-1983
($US thousand 1980)

Agricultural operations	1975		1976		1977		1978		1979		1980		1981		1982		1983	
	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent	value	per cent
Soil preparation	203,7	29.6	287.5	36.4	255.9	34.8	214.8	31.8	193,4	30.1	168.0	27.8	118.6	19.8	107,5	22.4	101,3	26.6
Sowing	50,0	7.2	42,3	5.4	31.8	4.3	28,8	4.3	29,6	4.6	40,6	6.7	24.7	4.1	19,8	4.1	25,3	6.6
Cultivation	4.5	1.0	12,3	1.6	11.4	1.6	10,6	1.5	11.0	1.7	17.0	2.8	18,1	3.0	11,9	2.5	10,7	2.8
Irrigation and Drainage	39,2	5.6	30,4	3.9	28,0	3.8	55,8	8.3	42,3	6,6	30,6	5.1	52,4	8.8	53,8	11.2	18,6	4.9
Pesticides application	36,2	5.3	51,4	6.5	67,3	9.2	59,5	8.8	57,6	9.0	42,4	7.0	45,4	7.6	42,8	8.9	30,9	8.1
Harvesting	269,3	39.0	273,2	34.5	234.4	31.9	177,7	26.3	212,5	33.2	205,3	34.0	222.0	37.3	138.5	28.8	118,3	31.1
Transportation and handling	21.2	3.6	25,6	3.2	46,2	6.3	38,5	6.0	31.0	4.8	31,3	5.2	29,1	4.9	30,5	6.4	26,2	6.9
Processing and storing	63.3	9.2	67.2	8.5	59,6	8.1	88.4	13.0	64.4	100.0	68,6	11,4	85.9	14,5	75,1	15.7	49,6	13.0
TOTAL SALES	687.4	100.0	789,9	100.0	734,6	100.0	674.1	100.0	641.8	100.0	603.8	100.0	596,2	100.0	479.9	100.0	380.9	100.0
INTERNAL MARKET	673,9	98.0	779,2	98.6	714,2	97.4	640,9	95.1	616.3	96.0	566,1	93.7	559.4	93.8	454.3	94.7	360.6	94.7

Source: Associacão Brasileira da Indústria de Máquinas e Equipamentos - ABIMAQ.

Table 12. Brazil: Value of sales of the main products among the agricultural machinery and implements, 1975-1983

Equipment	1975		1976		1977		1978		1979		1980		1981		1982		1983	
	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
PREPARATION OF SOIL																		
Plough (tractor-driven)	33.9	5.0	57.3	7.4	70.9	9.9	35.3	5.2	21.8	3.4	24.7	4.1	13.0	2.2	8.2	1.7	9.9	2.6
Plough Discs	-	-	0.1	0.0	0.1	0.0	5.5	0.8	3.9	0.6	2.5	0.4	2.2	0.4	5.0	1.0	3.2	0.8
Harrow Discs	-	-	-	-	-	-	17.4	2.6	14.8	2.3	16.8	2.8	21.8	3.6	24.9	5.2	15.6	4.1
Rotary Cultivator	5.7	0.8	9.2	1.2	9.0	1.2	4.6	0.7	5.2	0.8	5.2	0.9	3.2	0.5	5.0	1.0	2.7	0.7
Harrow (tractor drawn)	6.3	0.9	1.8	0.2	21.5	3.0	38.3	5.7	34.8	5.4	44.9	7.4	2.4	0.4	8.9	1.9	8.5	2.2
Plowing Harrow	12.9	1.9	52.2	6.7	23.4	3.3	9.6	1.4	7.6	1.2	7.3	1.2	10.9	1.8	11.0	2.3	6.3	1.7
Levelling Harrow	11.9	1.8	20.9	2.7	12.0	1.7	11.3	1.7	19.0	3.0	10.0	1.7	16.6	2.8	3.8	0.8	10.7	2.8
Front notched Blades	0.6	0.1	1.2	0.2	0.8	0.1	13.3	2.0	15.1	2.4	7.7	1.3	0.2	0.0	0.2	0.0	0.0	0.0
Post Hole Diggers	-	-	-	-	-	-	1.6	0.2	1.3	0.2	0.8	0.1	1.0	0.2	7.9	1.7	0.8	0.2
Rear Grader Blades	19.7	2.9	30.9	3.9	25.1	3.5	19.3	2.9	11.6	1.8	12.4	2.0	3.6	0.6	1.9	0.4	2.1	0.5
Rotavator	5.3	0.8	8.5	1.1	6.2	0.9	3.8	0.6	5.3	0.8	5.7	1.0	3.2	0.5	0.1	0.0	1.0	0.3
Rotary Cutters	16.3	2.4	15.3	2.0	15.4	2.1	11.3	1.7	16.0	2.5	13.8	2.3	17.7	3.0	11.3	2.3	10.6	2.8
Super Heavy Harrow	-	-	-	-	-	-	1.8	0.3	2.3	0.4	1.6	0.3	3.3	0.6	7.1	1.5	4.7	1.2
SEEDING, PLANTING AND FERTILIZING																		
Fertilizing Planter	14.6	2.2	18.2	2.3	17.5	2.4	12.6	1.9	10.0	1.7	22.3	3.7	10.9	1.8	7.1	1.5	13.3	3.5
Combine Drills	30.9	4.6	17.9	2.3	9.1	1.3	9.6	1.4	9.7	1.5	8.2	1.4	6.0	1.0	4.3	0.9	1.8	0.5
CULTIVATION																		
Cultivator (tractor driven)	2.8	0.4	11.3	1.4	10.0	1.4	8.6	1.3	8.8	1.4	13.2	2.2	14.9	2.5	8.5	1.8	6.6	1.7
Irrigation Equipment	-	-	-	-	-	-	20.3	3.0	9.8	1.5	8.7	1.4	22.1	3.7	23.6	4.9	9.3	2.4
Pumps	13.3	2.0	15.6	2.0	15.3	2.1	23.1	3.4	13.8	2.1	12.8	2.1	11.6	1.9	15.8	3.3	3.8	1.0
Pipe (witted with quick couplers)	-	-	-	-	-	-	10.3	1.5	10.0	1.6	6.4	1.1	14.7	2.5	11.4	2.4	4.1	1.1
PESTICIDES APPLICATORS																		
Sprayer	5.3	0.8	5.6	0.7	7.5	1.0	4.6	0.7	4.4	0.7	5.1	0.8	6.1	1.0	4.8	1.0	3.6	0.9
Boom Sprayers	12.5	1.9	19.3	2.5	23.3	3.2	15.0	2.2	11.5	1.8	10.0	1.7	10.2	1.7	16.8	3.5	12.6	3.3
Knapsack or manual Sprayers	11.4	1.7	13.8	1.8	25.3	3.5	24.0	3.6	12.9	2.0	7.0	1.2	10.6	1.8	6.8	1.4	3.9	1.0
Spread Sprayers	-	-	-	-	-	-	4.5	0.7	5.6	0.9	4.6	0.8	4.8	0.8	5.5	1.1	2.8	0.7
HARVESTING																		
Self-Propelled Harvesters	2b2.7	38.9	264.5	33.8	187.9	26.1	156.1	23.2	197.7	30.7	187.7	31.0	195.9	32.8	122.5	25.7	111.8	29.4
TRANSPORT AND HANDLING																		
Sugar Cane Loaders	1.3	0.2	6.9	0.9	9.0	1.2	7.5	1.1	5.5	0.9	3.9	0.6	9.2	1.5	6.5	1.3	4.3	1.1
Dumping or fixed farm wagon	15.2	2.2	11.4	1.5	17.9	2.5	9.9	1.5	9.1	1.4	8.5	1.4	6.3	1.0	6.7	1.4	4.6	1.2
Elevator	-	-	1.5	0.2	15.8	2.2	10.6	1.6	8.2	1.3	2.6	0.4	3.8	0.6	9.8	2.0	3.8	1.0
PROCESSING AND STORING																		
Rice Hulling & Grazing Machine	6.4	1.0	5.9	0.8	11.7	1.6	5.7	0.8	5.8	0.9	8.5	1.4	5.6	0.9	5.5	1.1	3.9	1.0
Grain Graders	0.8	0.1	2.9	0.4	8.4	1.2	9.4	1.4	6.1	1.0	7.4	1.2	10.9	1.8	5.2	1.1	5.6	1.5
Desintegrator	12.5	1.9	15.7	2.0	8.5	1.2	6.7	1.0	5.4	0.8	10.6	1.8	9.0	1.5	7.3	1.5	3.8	1.0
Forage Chopper and Grinder	4.9	0.7	2.8	0.4	6.3	0.9	5.0	0.7	3.2	0.5	3.1	0.5	2.9	0.5	5.8	1.2	3.8	1.0
Fixed Dryers	21.8	3.2	22.3	2.9	17.6	2.4	25.3	3.8	14.6	2.3	5.3	0.9	16.0	2.7	10.6	2.2	7.7	2.0
Separator	-	-	-	-	-	-	-	-	0.2	0.0	1.1	0.2	2.0	0.3	4.6	1.0	2.7	0.7
Silo	-	-	-	-	0.1	0.0	2.3	0.3	1.4	0.2	16.9	2.7	18.8	3.2	19.4	4.0	8.5	2.2
OTHERS	158.6	23.1	156.8	19.9	159.1	21.7	129.7	19.1	128.4	20.0	96.6	16.0	104.9	17.5	76.0	15.9	82.1	21.8
TOTAL	687.6	100.0	790.0	100,0	734.6	100.0	673.9	100.0	641.8	100.0	603.9	100.0	596.3	100.0	479.8	100.0	380.5	100.0

Source: Associação Brasileira da Indústria de Máquinas e Equipamentos - ABIMAQ.

5.1.4 Agricultural mechanization

Despite the large amount of machinery and equipment produced in Brazil, the degree of agricultural mechanization is still relatively small in the country. The overall number of tractors more than trebled between 1970 and 1980. But, compared to arable land, the 545,000 tractors existing in 1980 represent 8.7 tractors per one thousand hectares or 115.6 hectares per tractor. During 1980-1983, due to a reduction in sales and the great need for replacements, a significant decrease in the level of mechanization occured.

Table 13 presents some statistics on the main agricultural machinery and implements. It is interesting to see that the mechanical traction plough is being used at the same rate as tractors and, at the same time, substituting the animal-pulled ploughs. It can also be noticed that with time a clear preference for highly powered tractors emerges.

5.1.5 Foreign trade

Imports and exports of agricultural machinery and implements are of little importance in the domestic industry. In fact, based on the value of sales made by ABIMAQ (see table 11) in the period 1975-1983, the foreign market absorbed less than 7 per cent of the total sales.

Another way of evaluating this situation is by comparing the production value of the industry for the year 1980 ($US 1.7 billion) with the total exported ($US 145 million) and imports, which amounted to less than $US 15 million.

An analysis of exports and imports through the period 1975-1984, shows that the balance of trade is very favourable for Brazil and the ratio exports value/imports value rose from 0.33 in 1975 to 9.9 in 1980 and 57.2 in 1984.

Table 13. Brazil: Agricultural machinery and implements in operation

Items	1950 Units	1960 Units	1970 Units	1970 Per cent	1975 Units	1975 Per cent	1980 Units	1980 Per cent
Tractors	8,372	61,324	165,870	100.0	323,113	100.0	545,289	100.0
less than 10 HP			19,620	11.8	26,773	8.3	27,567	5.1
10 to 50 HP			80,952	4.8	86,870	26.9	128,944	23.7
50 to 100 HP			61,554	37.1	188,892	58.4	329,023	60.3
more than 100 HP			3,744	2.3	20,778	6.4	59,671	10.9
Harvesters			84,707		98,184		119,076	
Ploughs			1,878,925	100.0	2,093,960	100.0	2,236,577	100.0
Animal-drawn			1,718,041	91.4	1,758,051	84.0	1,677,408	75.0
Tractor-driven			160,884	8.6	335,909	16.0	559,169	25.0

Source: IBGE, Censos Agropecuários do Brasil.

Imports

The value of foreign purchases shows a more or less steady decline for the period 1975-1984, decreasing from $US 76 million to less than $US 2 million, which indicates that the domestic industry is practically self-sufficient in the sector. During this period, the year 1976 stands out, when imports declined by two-thirds (see table 14).

As to the composition of imports, the most important group throughout the period is that of harvesting and threshing machinery. However, this same category accounted for the drastic reduction of total imports in 1976, when the self propelled combine harvester-thresher was substituted by products made in Brazil. Other important categories are dairy machines, machines for wine-making and similar activities and machinery used in the grain milling industry. These are all connected to the food and beverages industries which are undergoing a modernization and expansion process.

It is important to note that more than a third of the total value of imports in later years are for spare parts and components, probably for machinery and implements bought before the import substitution era.

Exports

The total value of exports (see table 15) increased steadily from 1975 ($US 25 million) to 1981, when they reached a peak of $US 163 million, with a sharp decrease in the two following years, and a recuperation in 1984, nearing $US 100 million.

The increase of exports is closely related to the sales of tractors, a product that, in the period 1977-1982, surpassed exports of other articles significantly, as it accounte[illegible]ver 60 per cent of the total exports.

Another important [illegible] of harvesting and threshing machinery especially self-propel[illegible]ester-threshers. Thus, this type of machine plays an impor[illegible]e balance of trade of Brazil.

Table 14. Brazil Imports of agricultural machines and implements - 1975-1984

(US$ thousand CIF)

BTN	PRODUCT GROUP AND MAIN ITEMS	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984	
82.01	HAND TOOLS FOR AGRICULTURE	766,9	1.0	240,2	0.4	339,7	2.0	517,1	4.1	470,9	4.1	444,5	3.0	343,4	4.3	338,5	4.0	163,8	3.2	100,2	6.0
	- Curved machetes	238,2		73,0		132,8		234,3		238,9		210,6		133,6		307,5		122,8		80,1	
	- Spades, hoes, picks, shovels and mattocks	94,5		3,1		3,3		6,6		3,5		5,3		1,0		0,9		0,2		1,0	
	- Hedge shears	37,4		24,4		45,8		65,1		37,8		34,2		8,1		2,7		3,6		1,7	
	- Bill hooks and machetes	252,8		82,4		100,5		124,7		66,4		78,3		177,2		3,1		0,1		-	
84.21	SPRAYERS, DUSTERS AND SIMILAR	820,3	1.1	307,7	1.2	1,037,3	6.1	735,6	5.8	620,0	5.3	2,299,7	15.7	540,0	6.8	300,1	3.5	121,7	2.4	17,1	1.0
	- Power sprayers	730,1		139,7		122,7		104,8		284,8		2,160,4		379,9		176,2		18,7		-	
84.24	MACHINERY FOR SOIL PREPARATION AND CULTIVATION	1,949,9	2.6	1,178,9	4.6	1,044,0	6.2	926,0	7.3	1,008,1	8.7	885,6	6.0	722,3	9.1	768,8	9.0	508,0	10.0	70,6	4.2
	- Cultivators	101,3		8,5		69,1		80,0		7,1		12,0		-		139,3		293,5		15,6	
	- Disc harrows	135,0		0,9		202,2		16,2		12,2		0,8		3,2		23,2		-		-	
	- Fertilisers distributors	130,4		215,9		11,9		25,8		33,4		16,5		1,6		28,4		-		2,6	
	- Seeders, combined seed and fertiliser distributors, planters, transplanters	326,5		394,3		63,1		68,8		49,0		122,1		17,1		73,8		153,7		3,6	
	- Composed units (tractor and implement) for soil preparation and cultivation	353,9		6,5		107,0		200,4		424,2		198,0		460,6		98,6		-		1,0	
	- Parts	497,0		317,0		357,9		470,4		440,6		445,0		78,3		326,5		48,8		26,2	
84.25	HARVESTING AND THRESHING MACHINERY AND SIMILAR	55,328,2	72.7	15,850,1	61.5	5,289,5	31.2	5,418,7	42.9	3,748,2	32.3	3,757,5	25.6	3,209,6	40.4	2,551,2	41.6	2,187,5	43.2	463,0	27.7
	- Combine harvester-thresher	45,262,9		9,258,1		1,063,9		3,378,0		813,1		76,6		170,7		189,8		364,8		108,0	
	. self-propelled	43,861,1		8,618,6		945,7		3,285,2		653,5		46,5		84,9		-		364,8		9,4	
	- Baling-presses	-		62,1		17,8		193,2		3,3		33,1		-		218,4		-		-	
	- Lawn mowers	842,2		226,3		85,5		219,5		147,2		58,8		52,0		40,0		10,0		10,1	
	. other than motor driven	563,3		64,5		7,0		9,5		13,5		9,8		0,4		5,5		1,8		1,2	
	. motor driven	278,9		161,8		78,5		210,0		133,7		49,0		51,6		34,5		8,2		8,9	
	- Caifeblitz lawn mowers	1,774,8		575,0		345,7		421,5		407,3		839,7		378,5		369,0		170,8		0,2	
	- Cleaning, winnowing and sorting machines for grains, seed and similar	226,7		253,6		199,9		89,1		640,1		151,2		118,4		453,4		630,5		74,6	
	- Machines for grading eggs, fruits, potatoes, onions and other products	251,2		27,7		14,9		-		164,2		-		-		-		726,6		-	
	- Parts	5,073,1		3,061,8		2,236,2		937,0		1,075,8		3,098,9		2,003,2		1,103,5		559,0		270,1	
84.26	DAIRY MACHINES	1,268,8	1.7	1,125,5	4.4	1,481,6	8.7	1,330,9	10.5	2,068,1	17.8	1,140,7	7.8	640,8	8.1	457,3	5.4	598,8	11.8	298,7	17.9
	- Milking machines	333,3		229,2		59,1		150,1		133,1		104,4		26,2		21,6		33,5		-	
	- Milk homogenisers	126,8		83,7		184,8		144,4		269,4		182,9		163,2		192,4		113,4		47,1	
	- Cheese-making machines	225,3		41,4		7,6		505,0		56,7		303,2		36,6		-		-		8,5	
	- Parts	317,4		535,6		506,1		388,3		691,5		517,6		316,0		130,3		234,8		232,0	
84.27	PRESSES, CRUSHERS, AND OTHER MACHINES FOR WINE MAKING AND SIMILAR	553,1	0.7	259,3	1.0	609,3	3.6	111,6	0.9	1,942,1	16.7	673,7	4.6	774,0	9.7	115,3	1.4	53,3	1.1	245,1	14.7
	- Crushing machine and presses	431,4		250,1		361,9		57,6		1,472,7		214,7		203,4		43,9		43,2		41,2	
84.28	OTHER MACHINES	323,8	0.4	619,7	2.4	180,7	1.1	913,6	7.2	566,9	4.9	691,0	4.7	205,4	2.6	794,4	9.3	704,4	13.9	131,6	7.9
	- Automatic watering-troughs	19,8		32,5		10,5		12,2		39,9		58,6		0,2		5,7		41,8		-	
	- Germination appliances	27,3		23,6		2		0,9		11,9		3,0		-		65,2		430,1		-	
	- Poultry incubators	42,1		0,5		1,		30,9		1,8		127,4		25,9		77,4		17,9		11,7	
	- Parts	109,3		170,0		141,4		78,1		97,0		269,6		68,9		66,1		68,0		13,2	
84.29	MACHINERY USED IN BREAD GRAIN MILLING INDUSTRY AND OTHER	5,660,2	7.4	2,660,1	10.3	4,602,3	27.1	2,422,9	19.2	1,064,1	9.2	3,631,1	24.8	1,460,9	18.4	2,176,8	25.6	727,0	14.4	264,9	15.8
	- For mixing, cleaning and preparing grain prior to milling	588,9		118,1		191,3		291,2		115,2		299,7		2,8		-		30,6		23,9	
	- Grinding or crushing machinery	1,938,6		1,077,0		3,525,2		1,644,5		107,5		899,3		414,8		199,5		108,6		71,9	
	. weighing 5000 kg or less	1,042,3		982,9		752,7		1,644,5		107,5		495,5		291,8		89,6		6,4		71,9	
	- For sorting and separation flour and other milling products	511,4		474,5		175,5		22,1		143,7		331,2		5,4		216,8		82,9		-	
	- Parts	690,3		856,5		401,5		338,2		432,0		1,641,3		854,6		943,8		504,9		169,1	
87.01	TRACTORS	9,437,8	12.4	3,522,7	13.7	2,390,0	14.0	267,3	2.1	131,1	1.0	1,138,1	7.8	48,8	0.6	38,2	0.4	-	-	81,1	4.8
	- Four-wheeled tractors for agriculture	9,400,2		3,419,5		4,355,8		200,2		125,3		1,127,8		-		38,2		-		72,2	
	TOTAL	76,109,0	100.0	25,764,2	100.0	16,974,4	100.0	12,643,7	100.0	11,619,5	100.0	14,661,9	100.0	7,945,2	100.0	8,540,6	100.0	5,064,5	100.0	1,672,3	100.0

Source: Centro de Informações Econômicas e Fiscais - CIEF, Ministério da Fazenda.

Table 15. Brazil: Exports of agricultural machines and implements - 1975-1984

(US$thousand FOB)

BTN	PRODUCT GROUP AND MAIN ITEMS	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984	
82.01	HAND TOOLS FOR AGRICULTURE	2,578,9	10.4	1,178,5	6.5	3,008,6	5.2	3,136,5	4.1	3,533,5	3.5	3,844,9	2.7	4,605,4	2.8	4,382,1	4.2	6,915,2	12.7	5,815,5	6.0
	- Scythes and Sickles	21,7		23.3		49,2		87,6		64,3		78,3		96,1		50,7		343,6		44,1	
	- Spades, hoes, picks, shovels and mattocks	1,640,3		765,2		2,152,9		2,201,3		2,098,5		1,871,3		2,379,5		2,837,4		3,628,2		3,302,7	
	- Axes, hatchets and similars	479,2		168,7		321,6		387,2		820,4		893,5		1,021,7		710,4		240,3		659,9	
	- Bill hooks and machetes	266,9		120,8		229,0		241,3		332,1		736,9		745,6		403,9		2,409,4		1,351,8	
84.21	SPRAYERS, DUSTERS AND SIMILAR	1,845,7	7.4	1,276,7	7.1	3,569,0	6.1	5,364,1	7.0	4,754,0	4.7	6,378,1	4.4	6,029,3	3.7	2,931,5	2.8	2,387,7	4.4	3,466,5	3.6
	- Manual sprayers	602,7		380,6		956,6		1,189,8		1,192,7		1,747,4		2,083,5		797,6		603,1		1,739,9	
	- Power sprayers	798,2		671,5		2,023,0		3,434,3		2,648,9		3,229,5		2,898,3		1,370,4		909,5		1,726,6	
84.24	MACHINERY FOR SOIL PREPARATION OR CULTIVATION	4,493,3	18.1	3,748,5	20.8	6,882,9	11.8	7,013,4	9.1	12,886,5	12.8	20.563,9	14.2	13,722,9	8.4	13,428,6	12.8	4,877,6	9.0	24,745,3	25.3
	- Mouldboard ploughs	98,5		158,1		146,0		110,3		180,6		125,7		148,3		16,3		59,4		1,549,1	
	- Disc ploughs	1,032,0		895,0		1,493,5		1,018,4		1,345,1		2,530,7		1,765,5		1,386,9		1,399,1		2,761,9	
	- Ploughs fitted with shares or teeth	65,1		63,6		118,5		84,9		142,6		402,9		259,1		171,3		94,9		126,0	
	- Scarifiers	238,5		49,4		37,9		69,3		81,5		72,7		185,5		180,0		89,2		133,9	
	- Cultivators	88,6		82,4		427,6		242,6		192.6		171,3		367,6		62,9		83,0		59,3	
	- Weeders	-		-		2,5		10,9		0,1		961,1		275,4		339,2		339,7		9,6	
	- Disc Harrows	1,128,2		1,004,7		1,947,1		3,541,9		7,856,5		11,186,2		4,863,4		3,213,3		1,887,4		6,496,9	
	. Drawn	355,2		377,7		1,110,1		2,746,0		6,957,2		7,342,4		3,862,0		2,626,9		1,140,6		6,286,9	
	. Hidraulic lifting	642,4		626,9		818,9		766,6		852,4		1,267,1		659,3		539,0		730,0		210,0	
	- Seeders, combined seed and fertiliser distributor, planters	927,9		849,1		1,722,3		991,6		1,485,4		1,471,8		2,266,6		1,396,6		691,2		1,483,7	
	- Composed unit (tractor and implement) for soil preparation or cultivation	46,1		7,4		29,0		48,4		78,9		266,9		308,8		93,9		25,4		69,3	
	- Parts	647,2		340,6		479,1		453,5		799,5		1,825,6		1,732,7		5,699,0		8,7		11,549,9	
84.25	HARVESTING AND THRESHING MACHINERY AND SIMILAR	7,942,4	31.9	5,860,6	32.6	10,242,6	17.6	10,021,8	13.0	11,662,8	11.6	19,318,8	13.2	26,389,6	16.2	11,490,6	10.9	10,323,8	19.0	27,271,4	28.0
	- Combine harvester-threshers	5,108,5		3,610,2		6,525,8		6,551,1		8,752,1		12,846,3		17,792,2		6,298,8		5,440,8		13,980,6	
	. Self-propelled	4,793,2		2,805,1		5,088,5		6,211,3		8,473,9		12,234,7		16,490,9		5,936,4		5,361,0		12,121,4	
	. Other	315,3		805,1		1,437,3		339,8		278,2		611,6		1,301,3		362,5		79,8		1,859,2	
	- Maize threshers and similars	1,743,6		1,314,6		2,124,2		1,196,0		610,8		754,4		1,500,5		1,412,9		699,9		646,7	
	. Corn shellers	592,2		486,6		325,2		450,7		237,0		365,2		639,0		570,4		98,2		389,1	
	. Threshers	1,138,1		729,8		1.731,9		660,0		251,2		286,3		661,9		759,0		554,8		35,2	
	- Baling-presses	449,5		317,8		531,1		843,5		14,8		125,4		244,0		417,2		403,3		2,192,1	

Table 15. Brazil: Exports of agricultural machines and implements - 1975-1984 (continued)

(US$thousand FOB)

BTN	PRODUCT GROUP AND MAIN ITEMS	1975		1976		1977		1978		1979		1980		1981		1982		1983		1984	
	- Lawn mowers	27,0		40,6		79,5		62,6		169,2		585,2		692,9		169,2		862,4		270,4	
	. Other than motor-driven	13,1		4,5		23,0		13,2		105,6		369,0		380,3		58,9		298,5		195,3	
	. Motor-driven	13,9		36,1		56,5		49,4		63,6		216,2		312,6		110,3		563,9		79,1	
	- Cleaning, winnowing and sorting machines for grain, seed and similar	247,0		273,3		461,7		714,8		1,261,2		3,355,7		3,060,2		2,132,3		1,664,0		9,114,3	
	. For grading grains, seed and similar by photocell system	16,7		-		46,2		206,0		187,8		456,9		570,3		255,8		495,0		626,2	
	. Other types	87,4		240,0		83,4		171,8		509,0		1,774,1		333,9		1,197,7		515,4		1,787,4	
	- Machines for grading eggs, fruit, potatoes, onions and other products	1,7		94,6		142,0		49,3		210,0		476,9		276,2		30,2		95,0		72,2	
	- Parts	230,4		170,3		357,6		447,1		525,5		1,043,6		2,013,7		956,5		1,121,2		926,6	
84.26	DAIRY MACHINES	6,5	0.0	62,9	0.3	128,0	0.2	53,8	0.1	218,0	0.2	131,8	0.1	1,140,6	0.7	180,1	0.2	108,9	0.2	370,1	0.4
84.27	PRESSES, CRUSHERS AND OTHER MACHINERY FOR WINE MAKING AND SIMILAR	5,3	0.0	16,9	0.1	3,7	0.0	2,5	0.0	11,3	0.0	698,7	0.5	838,8	0.5	45,1	0.0	41,9	0.1	49,1	0.1
	- Crushing machines and presses	3,9		15,0		1,2		2,4		8,2		649,9		731,5		16,1		-		14,0	
84.28	OTHER MACHINES	412,7	1.7	1,170,4	6.5	1,175,1	2.0	1,312,2	1.7	1,390,8	1.4	1,709,5	1.2	2.277,5	1.4	1,635,6	1.6	1,616,2	3.0	1,657,1	1.7
	- Machines for grinding or milling grain	-		-		10,0		45,4		28,3		139,3		145,8		65,0		46,6		182,3	
	- Automatic watering-troughs	10,9		-		18,6		20,4		35,7		83,9		81,4		516,7		179,9		96,1	
	- Straw crushing machines	318,0		306,2		142,7		148,4		551,3		231,1		110,0		79,0		709,3		600,2	
	- Poultry incubators	4,2		-		105,1		106,2		92,1		168,2		118,6		3,9		93,7		-	
	- Brooders	5,3		8,5		-		17,2		89,2		237,8		215,2		15,8		27,7		22,9	
84.29	MACHINERY USED IN BREAD GRAIN MILLING INDUSTRY AND OTHER	1,432,2	5.8	1,084,5	6.0	1,830,6	3.1	1,832,4	2.4	3,132,6	3.1	2,510,2	1.7	5.157,3	3.3	5,979,0	5.3	4,747,5	8.6	2,427,9	2.5
	- For mixing, cleaning and preparing grain prior to milling	309,8		622,8		878,5		1,302,4		1,652,6		1,223,0		2,382,3		2,840,2		1,834,1		1,178,9	
	- Grinding or crushing machinery	77,4		31,6		85,6		57,3		47,6		216,3		1,408,7		616,0		1,642,1		398,9	
	Weighing 5,000 kg or less	77,4		31,6		85,6		57,3		47,6		216,3		750,4		555,8		179,3		258,6	
	. Other	-		-		-		-		-		-		658,3		60,2		1,462,8		140,4	
	- For sorting and separating flour and other milling products	2,1		18,6		5,7		12,7		725,0		115,8		278,8		1.737,9		378,2		315,7	
	- Parts	99,7		116,9		133,4		70,9		211,2		125,5		326,2		255,4		209,2		247,5	
87.01	TRACTORS	6,167,8	24.7	3,631,4	20.1	31,518,0	54.0	48,130,4	62.6	63,160,6	62.7	89.851,8	62.0	102,477,5	63.0	65,454,3	62.2	23.357,1	43.0	31,466,9	32.0
	- Small-wheeled tractors (4 wheels) for use in agriculture and horticulture	195,6		188,0		342,5		537,2		858,4		321,6		6,7		15,0		24,8		22,8	
	- Two-wheeled tractors for use in agriculture and horticulture	126,2		304,2		192,2		253,1		401,7		777,9		410,8		242,6		298,5		485,5	
	- Four wheeled tractors for agriculture	5,846,0		3,139,2		30,983,3		47,340,1		61,900,5		88,752,3		102,060,0		65,196,7		23.073,8		30,958,6	
	TOTAL	24,884,8	100.0	18,030,4	100.0	58,358,5	100.0	76,867,1	100.0	100,750,1	100.0	145,007,7	100.0	162,638,9	100.0	105.126,9	100.0	54,375,9	100.0	97,269,8	100.0

Source: CACEX - Banco do Brasil.

Other categories that stand out in the export profile are: cleaning, winnowing and sorting machines for grains, seeds, etc., disc harrows, and some hand tools.

5.2 Chile

5.2.1 Development of the agricultural machinery and implements industry

As in the case of other Latin American countries, the manufacture of agricultural machinery developed from small workshops for the repair of industrial equipment and machinery.

The beginning of these workshops date from the first quarter of this century, for example the firm of Schulze e Stimper was founded in 1923, and is still in operation. However, only as a result of restrictions on imports made necessary by World War II, and the establishment of the first steel mill (Compañía de Acero del Pacífico - CAP) in the 1950s, did the agricultural machinery industry and metalworking activity as a whole begin, in fact, to develop. Several firms date from that period, such as: Pulverizadores Parada, Ramon Zambrano Villaseñor, José Godoy, to mention some of those still in operation. This development was supported by a trade restriction policy in favour of the infant national industry.

In the 1960s, as a consequence of the industrial development process brought about by the Chilean Government through Corporación de Fomento de la Producción (CORFO), significant progress was made in the production of agricultural equipment and implements. CORFO stimulated the creation of new companies or the development of the existing firms under foreign license which, besides permitting a technology transfer, expedited the marketing of goods in the domestic market and the sales of surpluses abroad. This is the case of Metalúrgica Sudamérica, which started manufacturing discs for ploughs and harrows under a license of the English firm of W.A. Tyack and C. Ltd.; the case of Ransomes Chilena Ltda., manufacturers of a complete line of products for the preparation of soil, under a license of the English firm of Ransomes; the case of Magrinsa, in Lautaro, producers of machinery for the preparation

of soil, rotary hoes and hammermills, under a license of the American firm of Wetmore. The same occurred with Pulverizadores Parada S.A., which developed under a license of John Bean, an American firm.

These companies, which were specifically designed for the manufacture of the above-mentioned machinery, had an exportable surplus that enabled them to participate in the broad market of the South Andean Region. Exports, (protected by decision no. 57 of Programa Metalmecánico of the Cartagena Agreement) met with extraordinary success until 1976, especially for Ransomes de Chile, Parada S.A., and Metalúrgica Sudamericana.

The favourable conditions of this period also helped to strengthen existing plants, increasing their productive capacity and diversifying their product range.

The boom, however, lasted only until the beginning of the 1970s, when the Chilean economy suffered a significant setback. This had a radical effect on the agricultural sector, decreasing investments to a minimum, with a drastic reduction in demand for agricultural machinery and implements.

Since the 1970s, the government instituted the so-called social market economy with the following main characteristics:

(a) Overall decrease of import duties to a 10 per cent level for all items without restrictions on licenses or down payments or specific rights to the merchandise;

(b) A consistent foreign exchange policy with a planned devaluation of the Chilean peso vis-à-vis the United States dollar in the first stage, followed by a fixed exchange parity for a period of three years and free access to the foreign exchange market;

(c) The absence of an agricultural mechanization policy in line with the activities of the industrial sector required to promote agriculture;

(d) Lack of a credit policy to finance the acquisition of domestically produced agricultural machinery.

This situation together with subsidies for exports of agricultural machinery granted by other countries, made it very difficult for the domestic industry to compete with imports.

This process resulted in the closing down of several important firms, such as Ransomes de Chile and Magrinsa and created a very difficult situation for those industries still in operation.

Since 1983, a better defined policy for the development of the agricultural sector was adopted, especially a more realistic exchange policy and the establishment of price brackets for agricultural products, as well as levels of customs duties more compatible with the industrial development (35 per cent). These measures together led to a substantial increase in planted area with traditional crops and an incentive for the domestic industry in terms of new operating units, renewed designs and quality competitive with imported articles.

5.2.2 The industry: manufactured products and their characteristics

Based on data from the Directorio de Fabricantes y Distribuidores de Equipos Agrícolas, published in 1985, 40 producers were identified. It must be pointed out that this total includes many micro-companies or even craft-shops. Only 30 per cent of these industries are located outside the metropolitan area or its vicinity.

The activities of each firm, in terms of the agricultural processes, as well as the manufactured products, are shown in table 16. The following conclusions can be drawn from that table:

(a) There is a significant degree of specialization in the sector at the product level. As can be seen from table 17, 27.5 per cent of producers manufacture only one product, 10 per cent make two articles, and only 10 per cent of the firms produce more than five items;

Table 16. Chile: Manufacturers of agricultural machines and implements - 1985

ENTERPRISES	PREPARATION OF SOIL																				SEEDING, PLANTING AND FERTILIZING						CULTIVATION			HARVESTING					PEST: APPLICA		
	PLOWS	Disc plows 3 point hitch	Chisel plows 3 point hitch	Chisel plows (drawn)	Plow handle	Chisel Plows (animal-drawn)	Middlebreaker plows (animal drawn)	"Malgador" plows	Trailed plows	HARROWS	REAR BLADES	HARROWS	Disc Harrows-3 point hitch	Disc Harrows - trailed	Combine Harrow	Tooth Harrow (animal drawn)	EARTH ROLLERS	PAY LOADER	AGRICULTURAL SCRAPERS	TOTAL	SEEDERS	COMBINE DRILL	NITRATE DISTRIBUTORS	SULFUR SPREADERS	DUSTERS (tractor driven)	TOTAL	CULTIVATORS	Animal-drawn	Mechanical	ROTATIVE HARVESTERS	FORAGE HARVESTERS	HAYMAKING SET	Manual	Hydraulic	TOTAL	SPRAYERS (manual)	DUSTERS	SPRAYERS (integral)
Aerobombas Guillermo Mohr																																					x
Agricosan			x	x										x						3																
Almenara y Cia.Ltda.																																					
Bittig y Boilat, Maestranzas Suiza S.A.																																					
Breuer Lindemann, Reiner				x		x							x			x				4										x		x		2			
Curifor S.A.			x																	1																	
Dalmi Ltda.							x	x												2	x	x			2	2	x	x									
Decopac Ltda.																																					
Edyce-Ingenieria Industrial S.A.			x	x										x						3							1		x							
FAMAE					x															1							1	x								
Fundicion Iberia																					x				1				x				1			
Gamonal S.Jaime			x	x							x									3																
GHC, German Holzapfel y Cia.Ltda.																																					
Gildemeister S.A.C.			x	x										x						3							•									
Godoy Jose e Hijo Ltda.			x	x										x						3																
Goren y Cia.Ltda.																																					
Hasberger y Cia. Ltda. - Suizital																																					
ICAT Ltda.					x											x				2							1	x								
Incomag Ltda.-Industria de Maquinarias																																					
Industria Mecanica Vogt S.A.																																					
INFUMAG																																					x
Lara N, Eugenio - Frytma		x												x						2																
Levera Fabrizio																									•												
Maestranza Bolomey																x	x			2																x	x
Maestranza Sermann																																					
Maria Yolanda Vasquez T - Mayov																							x			1											
Metalurgica y Compactadores Ltda.																																	x	1			
Mirosolar																																					
Metalurgica Sudamericana S.A.-Metalsa																																					
MONTESA																																					
Peleco-Guillermo Gonzalez Cruchaga																																					x
Pulverizadores Agricolas Parada S.A.																																			x	x	x
Pulverizadores Rial																																					x
Savard J. e Hijos Ltda.-CIMA							x		x		x			x				x	x	6				x		1										
Schulze y Stimper Ltda.					x										x	x				3																
Sociedad Comercial Victor Hadad e Hijo																								x	x	2											
Sociedad Industrial Pizarreño S.A.																																					
SOCECO S.A.			x	x																2																
Tapia e Hijo Ltda., Amador																																			x		
WENCO S.A.																																			x		
Zambrano V. Ramon			x	x			x	x	x		x							x		7																
TOTAL	1	8	8	3	1	3	2	2	1	2		1	6	1	4	1	2	1		16	2	1	1	2	1	5	4	3	2	1	1		1	1	3	4	4	5

Source: Based on "Directorio de Fabricantes y Distribuidores de Equipos Agricolas". 1985.

SECTION 1

				SEEDING, PLANTING AND FERTILIZING						CULTI-VATION			HARVESTING						PESTICIDE APPLICATION						PROCESSING										TRANSPORTATION AND STORING									WATER SUPPLY & IRRIGATION				PARTS	HAND TOOLS	TOTAL	
[illegible]	PAY LOADER	AGRICULTURAL SCRAPERS	TOTAL	SEEDERS	COMBINE DRILL	NITRATE DISTRIBUTORS	SULFUR SPREADERS	DUSTERS (tractor driven)	TOTAL	CULTIVATORS	Animal-drawn	Mechanical	POTATOES HARVESTERS	FORAGE HARVESTERS	HAYMAKING SET	Manual	Hydraulic	TOTAL	SPRAYERS (manual)	DUSTERS	SPRAYERS (integral)	SPRAYERS (mechanical)	SPRAYERS (animal)	TOTAL	HAMMER MILLS	FLOUR MILLS	PACKING SETS	MIXING MACHINES	BAGGIN MACHINES	GRAIN DRYERS	FOOD PROCESSING MACHINES	FRUIT DEHYDRATORS	CHOPPERS AND GRINDERS	TOTAL	FARM WAGONS	WAGONS FOR FRUITS	FORAGE WAGONS	DUMPING FARM WAGONS	SILOS	ENDLESS BELT CONVEYORS	BUCKET ELEVATOR	BUNDLE LOADERS	TOTAL	HYDRAULIC PUMPS	IRRIGATION SYSTEMS	WIND MILLS	TOTAL	DISCS	HAND-TOOLS	NUMBER OF PRODUCTS	AGRICULTURAL OPERATIONS
																					x			1													x						1	x		x	1			4	3
			3																																	x	x						2							5	2
																											x							1																1	1
																									x		x	x						3																3	1
			4											x		x		2							x	x								2																8	3
			1																																															1	1
			2	x	x				2	2	x	x																							x								1							7	4
																													x					1																1	1
			3							1		x																																						4	2
			1							1	x																																						1	3	3
				x					1				x					1																								x	1			x	1			4	4
			3																																															3	1
																																												x			1			1	1
			3																																															3	1
			3																																	x	x						2							5	2
																																			x	x	x						3							3	1
																														x	x			2					x	x			2							4	2
			2							1	x																																							3	2
																											x							1																1	1
																																												x			1			1	1
																			x					1																										1	1
			2																																															2	1
																				x	x	x	x	4																										4	1
			2																						x									1				x					1							4	3
																									x	x								2					x	x	x		3							5	2
						x			1																x									1	x								1							3	3
																	x	1														x		1																2	2
																																																1	1	2	2
																													x					1																1	1
																				x	x	x		3													x						1							4	2
																			x	x	x	x		4																										4	1
							x		1											x				1																										2	2
	x	x	6																														x	1		x	x						2							9	3
			3																																														1	4	2
							x	x	2												x	x		2																										4	2
																																													x		1			1	1
			2																																x	x	x						3							5	2
																			x					1																										1	1
																			x					1																										1	1
	x		7																																x								1							8	2
.	2	1	16	2	1	1	2	1	5	4	3	2	1	1		1	1	3	4	4	5	4	1	9	5	2	3	1	2	1	1	1	1	12	5	5	7	1	2	2	1	1	14	3	1	2	5	1	3		

SECTION 2

(b) The specialization is also significant with regard to the stages of the farming processes, as shown in table 18, since fifty per cent of the producers (22) concentrate on just one stage. Spraying and processing are provided for best with five firms participating at each stage. Soil preparation comes second with four firms.

(c) The variety of products for a single stage of the farming process is greater in the case of soil preparation, which makes use of twelve products, followed by spraying, employing eleven;

(d) The higher concentration of industries is noted in soil preparation, which is provided for, but not necessarily exclusively, by 40 per cent of the firms. Processing and spraying come next, with 28 and 23 per cent, respectively;

(e) The products manufactured by a greater number of firms are:

(i) Ploughs: made by 15 firms, some types exceeding others, e.g. chisel ploughs (three-point hitch) - 8 producers and chisel ploughs (driven) - 8 producers;

(ii) Harrows: made by 10 firms (9 out of them also produce ploughs). The greater number of manufacturers (6) concentrate on trailed disc harrows;

(iii) Forage wagons: made by 7 firms;

(iv) Sprayers, hammer mills, farm wagons and dump farm lorries have five producers each.

Although 40 firms are registered as producers of agricultural machinery, tools and implements, only a few are really important, such as (in alphabetical order):

Table 17. Chile: Number of products manufactured by the firms

Number of product types manufactured	Number of manufacturers	
	Units	Per cent
1	11	27.5
2	4	10.0
3	7	17.5
4	10	25.0
5	4	10.0
6	-	-
7	1	2.5
8	2	5.0
9	1	2.5
	40	100.0

Source: Table 6.

Table 18. Chile: Specialization of manufacturers

Operations	Manufacturers	Products
Soil preparation	4	12
Sowing, fertilization	-	-
Soil cultivation	-	-
Harvesting	-	-
Spraying	5	11
Processing	5	7
Transportation, storage	1	3
Irrigation	3	3
Parts	1	1
Hand tools	3	
Total	22	

Source: Table 6.

- AGRICOSAN - producer of harrows, chisel ploughs and farm wagons

- Edyce - producer of chisel ploughs, disc harrows and cultivators

- Gildemeister - producer of chisel ploughs and disc harrows

- Goren - producer of farm wagons

- J. Godoy - producer of chisel ploughs, disc harrows and farm wagons

- Parada - producer of sprayers and dusters

- R. Zambrano - producer of ploughs (chisel, subsoiler, middlebreaker, frontal loaders and farm wagons)

- SOGECO - producer of farm wagons and chisel ploughs.

The following are the characteristics of the enterprises analyzed for this survey:

(a) It is a small industrial sector and, as such, the production level of the firms is quite low. Parada is one of the most traditional and best developed firms which produced, in 1984, 150 tractor trailed boom sprayers; Metalúrgica Sudamericana, also important in this sector, produced 35 tons of discs in that year; Gildemeister estimates its production, in 1985, at 100 ploughs and 80 harrows, corresponding roughly to one third of the present country's demand; in 1984, SOGECO made 120 farm wagons and 60 ploughs.

(b) Several firms, among them some of the most important, are quite new or are still in the process of being established. Such is the case of Gildemeister and ICAT, which started operating in mid-1984.

(c) The capital of those firms is entirely nationally-owned.

(d) Many firms registered in this sector have their main activity or a subsidiary activity in another industrial sector. Such is the case of FAMAE - Fábrica de Material del Ejército, producer of army gear; SOGECO, which produces building implements; and Gildemeister, manufacturer of compressors for the mining industry and others.

(e) Several firms are mainly engaged in non-manufacturing activities, the production of agricultural machinery and implements being just another line of business. This is the case with ICAT Ltda., which operates in the construction and transportation sectors; CURIFOR, dealer in vehicles and parts; and Gildemeister, a traditional dealer turned into a manufacturer.

(f) Firms are generally small, employing in the agricultural line a small number of people, usually less than 30. Examples of this are Metalúrgica Sudamericana (maker of discs and tools) with a total labour force of 20 and ICAT, operating with just 14 people. Among the larger firms, Parada (sprayers) employs 75 people, and Gildemeister has 100 employees engaged in the manufacture as well as the maintenance of the equipment they sell.

(g) The utilization of production capacity ranges somewhere between 50 per cent and 70 per cent, but it is very difficult to make an estimate for firms that are just starting new lines.

(h) In the majority of firms, industrial activity is limited to the assembly of components ordered from third parties. This is the case for SOGECO and Gildemeister, although the latter will incorporate the metalworking activity as the production for the agricultural and mining sectors is being expanded and diversified. Exceptions are ICAT, which takes advantage of an industrial assembly line (including forging, welding, etc.) used in the manufacture of equipment for the oil industry; Parada has an agreement with other firms for smelting works.

(i) The majority of companies perform equipment maintenance and repair activities, including on items produced elsewhere, to provide service to their clients or to boost their revenues.

(j) Although it was customary in many cases at the formative stage of the industry, payment of licenses occurs very seldom.

(k) Only one firm, Metalúrgica Sudamericana, is presently engaged in exports of some account; others, such as Parada, have exported at the time of the Andean Pact.

(l) Inputs, except for ball bearings and specialty steels, mainly originate in Chile.

5.2.3 Growth of imports

Since the second half of the past decade, imports of agricultural machinery and implements have shown an oscillating behaviour, reaching a peak in the years 1980 and 1981, with the same amount of nearly $US 37 million. A decline was observed in 1982 ($US 7.8 million), becoming more accentuated in 1983 ($US 3.5 million). A recuperation was noticed in 1984, when imports reached $US 11.2 million (table 19).

One of the reasons for the reduction of imports which occurred during 1982 and 1983 was the high level of stocks on hand by importers in 1982.

Another very important reason is the decline in agricultural production in these years. According to National Accounting statistics, the GDP in the agriculture and forestry sectors was reduced in 1982 and 1983 by 2.1 and 3.6 per cent, respectively.

This situation is more clearly shown in the analysis of the area planted with traditional crops (table 20). According to Oficina de Planificación Agrícola (ODEPA) this area was reduced from 1,060,000 hectares in the 1980/81 farming season to 945,000 hectares, in 1981/82, and to 871,000 hectares, in 1982/83. That means an overall reduction of 19.4 per cent. Comparing the agricultural year 1982/83 with the 1977/78 season, when the planted area with traditional crops reached 1,285,000 hectares, the reduction reached

Table 19. Chile: Imports of agricultural hand tools, machinery, implements and tractors - 1976-1985

($US thousand CIF)

Years	Hand tools	Machinery and implements	Tractors	Total
1976	81	7,289	558	7,928
1977	348	10,717	9,650	20,715
1978	208	8,580	12,264	21,052
1979			12,900	
1980	848	20,051	15,548	36,447
1981	1,724	17,427	17,487	36,638
1982	812	5,943	1,068	7,823
1983	391	2,597	496	3,484
1984	1,033	7,960	2,195	11,188
1985a/	174	1,613	1,162	2,949

a/ First quarter.

Source: Banco Central do Chile.

Table 20. Chile: Seeded area with traditional cultivations

(Ha thousand)

Years	Grains	Leguminous and potatoes	Industrials	Total
1977/78				1,285
1978/79				1,250
1979/80				1,237
1980/81				1,080
1981/82	650	260	35	945
1982/83	635	194	42	871
1983/84	782	212	57	1,051
1984/85a/	908	245	82	1,235

a/ Estimate.

Source: ODEPA.

32 per cent. It should be added that the increase in the planted area with fruit crops, in the same period, was not enough to compensate for the drop in traditional crops (table 21).

In the 1983/84 season the trend is reversed, and a remarkable recovery (20 per cent) occurred in the planted area with traditional crops, reaching 1,051,000 hectares. For the 1984/85 period, the area is estimated at 1,235,000 hectares.

The above-mentioned recovery is mainly a response of the agricultural sector to new economic policies, such as: the periodical revision of exchange rates, increased customs duties, etc., as well as some measures aimed specifically at the agricultural sector, such as: price brackets for wheat and oilseeds and price support for sugar, benefitting the sugar beets producers.

To a large extent these oscillations in agricultural production may explain the development in the demand for agricultural machinery.

Another important factor influencing the behaviour of foreign purchases, in general, is the change in the costs of imports, resulting from customs and foreign exchange policies.

As can be seen in table 22, the real cost of imports was comparatively lower in 1980-1982 than in 1983 and much more so in 1984.

5.2.4 Composition of imports

As shown in table 20, imports of tractors between 1977 and 1981 accounted for approximately half of the foreign purchases of agricultural machinery as a whole. This reflects, in part, a repressed demand but also the normal need for replacements, estimated at 34,400 tractors in the agriculture and livestock census of 1976 (figure 2).

Table 21. Chile: Planted area and fruit production

Years	Area (ha)	Production (thousand tons)
1977/78	53,431	541
1981/82	65,625	837
1982/83	68,852	892
1983/84	71,765	966
1984/85[a/]	74,530	1,072

a/ Estimate.

Source: ODEPA.

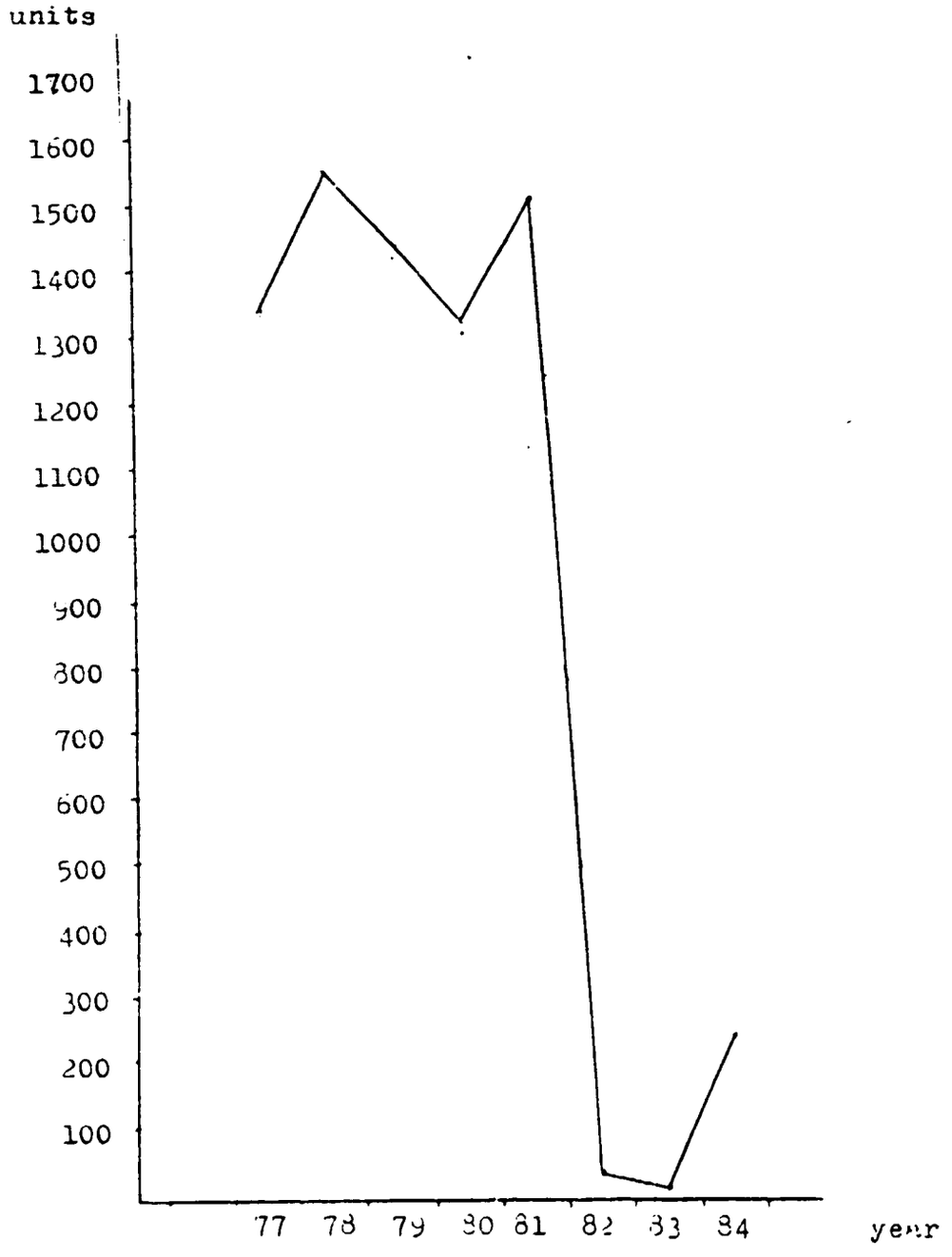
Table 22. Chile: Index of imports cost evolution - 1979-1984

Year	CIF and tariff index	Actual exchange rate index[a/]	Actual import cost index
1979	100.0	100.0	100.0
1980	100.0	88.4	88.4
1981	100.0	80.5	80.5
1982	100.0	97.6	97.6
1983	106.8	120.2	128.4
1984	112.5	128.5	144.5

a/ AER = Nominal exchange rate x $\frac{\text{Wholesale price index USA}}{\text{Retail price index Chile}}$

Source: Banco Central de Chile.

Figure 2. Chile: Imports of tractors



Source: Banco Central de Chile

Hand tools have been imported during the whole period under study, keeping a steady relationship with agricultural machinery and implements, as they have always accounted for between 5 and 15 per cent of the aggregate.

In the case of machinery and implements, it can be seen in table 23 that item 84.25 (Harvesting and Threshing Machinery and Appliances) is the most important during the period, absorbing between 33 per cent and 62 per cent. The relative importance of the remaining groups of products fluctuates throughout the period.

As to the origin of imports, excluding tractors, the main suppliers in recent years were: the United States, with 39 per cent of the total in 1984, Brazil with 20 per cent, and the Federal Republic of Germany with 13 per cent. Other regular suppliers, although less important, were Argentina, France and Italy.

Statistics for tractors indicate that the principal supplier has been the United Kingdon, followed by the United States, Brazil, Italy, West Germany, and Japan.

5.2.5 Distribution channels

The total number of dealers operating in Santiago's metropolitan area in 1984 reached about 25, however, only ten of these are significant.

As shown in table 24, they are all agents for foreign brands and three of these work only with tractors, four deal with tractors and implements and three operate with implements only. There is remarkable concentration in this activity: three firms account for more than three quarters of tractor sales and 72.4 per cent of implements. Gildemeister is prominent in both activities, being responsible for about one third of total sales.

Table 23. Chile: Imports of agricultural machinery and implements by item - 1976-1984[a/]
($US thousand CIF)

B.T.N.	Group of Products	1976	1977	1978	1979	1980	1981	1982	1983	1984
84.24	Agricultural and horticultural machinery and appliances for preparing and cultivating the soil	775 (10,7)	1,830 (17,1)	1,339 (15,C)		3,020 (15,1)	3,577 (20,5)	684 (11,5)	347 (13,4)	1,371 (17,2)
84.25	Harvesting and thresting machinery and appliances	3,765 (51,6)	4,824 (45,0)	2,861 (33,3)		7,893 (39,4)	5,965 (34,2)	2,434 (41,0)	1,283 (49,4)	4,950 (62,2)
84.26	Dairy machinery	1,941 (26,6)	1,627 (15,2)	1,077 (12,6)		968 (4,8)	1,006 (5,8)	945 (15,9)	137 (5,2)	879 (11,0)
84.27	Presses, crushers and other machinery used in winemaking, cider making etc.	63 (0,9)	495 (4,6)	181 (2,1)		434 (2,2)	711 (4,1)	190 (3,2)	51 (2,0)	109 (1,4)
84.28	Other agricultural, horticultural poultry-keeping and bee-keeping machinery	196 (2,7)	762 (7,1)	1 976 (23,0)		3,741 (18,7)	4 026 (23,1)	232 (3,9)	115 (4,4)	60 (0,8)
84.29	Machinery of a kind used in the bread grain milling industry, and other machinery for the working of cereals.	549 (7,5)	1,178 (11,0)	1 146 (13,4)		3,995 (19,8)	2,142 (12,3)	1,458 (24,5)	664 (25,6,	591 (7,4)
	TOTAL	7,289 (100,0)	10,716 (100,0)	8,580 (100,0)		20,051 (100,0)	17,427 (100,0)	5,943 (100,0)	2,597 (100,0)	7,960 (100,0)

Source: Banco Central de Chile

a/ Figures in brackets represent percentage shares of the total.

b/ Statistics are not available.

Table 24. Chile: Dealers of tractors and agricultural implements - 1984

Enterprise	Tractors	Implements	Number of Employees	Market Structure (%)	
				Tractors	Implements
Gildemeister	John Deere	FMC - Alfa Laval Lely - Kuhn - Bean John Deere	91	29.6	33.1
Atom	Massey Ferguson	Massey Ferguson Vicon - GHEL - J.F.	74	25.6	19.5
Williamson	Ford	-	32	20.6	
S.K.Comercial	International	International	60	10.3	13.4
Cidef	Valmet	-	23	9.2	
Maco	Pascuali David Brown	Cannor-Shea Bamford-Techoma	65	4.7	19.8
Derco	Landini	-	18		
Salfa	-	Athens - Gherardi Mainerd - Vasalli Holder	42		10.3
Sargent	-	Brillon - Gyro Ransome - Faga	12		2.7
Agromotriz	-	Sperry New Holland	19		1.2
				100.0	100.0

Source: Maquinaria Agricola. Facultad de Ciencias Economicas y Administrativas. Universidade de Chile - 1985.

5.3 Colombia

5.3.1 The agricultural machinery and implements industry

The agricultural machinery and implements industry started in Colombia at the beginning of the 1960s. It grew slowly from the need for replacement and maintenance of the tractor park and other imported agricultural machines.

The development of this industry has brought about a growing shar · of implements for tractors, such as ploughs, combine drills and cultivators, as compared to stationary milling or processing machinery, which used to dominate the market.

According to data from the Departamento Administrativo Nacional de Estadísticas (DANE), between 1961 and 1972 the value of domestic production of agricultural machinery and implements increased almost three-fold.

In the 1970s, as a result of the growth of the agricultural livestock sector (4.8 per cent per year), the continuing import substitution process, as well as an export boom, the agricultural machinery and implements industry expanded more rapidly. As an indication, according to DANE, the value of production in 1975 reached the equivalent of $US 11,500,000.

In 1982, according to the same source, the agricultural machinery and equipment sector was as follows:

- Number of establishments: 52
- Hired labour: 1,670
- Wages paid: $US 4,485,000
- Value of gross production: $US 19,745,000
- Aggregate value: $US 9,289,000.

These data show that the production value, in current dollars, increased over 70 per cent between 1975 and 1982. Although no exact information is

available concerning the size of industries in this sector, it is generally known that most of them are small companies. This conclusion may be indirectly drawn as, according to DANE, 78 per cent or 245 firms out of the 314 included in the CIUU group (manufacture of machinery, except electrical, i.e., including agricultural machinery and implements) had fewer than 50 employees.

Only a few of the firms registered in the sector are of any significance in the total and these are concentrated in the manufacture of implements, since tractors and related equipment are not produced in Colombia.

As to tractor driven implements, it is estimated that 90 per cent of the market is supplied by domestic production. The principal manufacturer is INTERAGRO, a firm with the following characteristics:

- Located in Bogotá
- 100 per cent Colombian capital
- Supplying the agricultural sector exclusively
- Specialized in soil preparation: produces implements for tractors (trailed plough-harrows hydraulically operated, disc harrows, disc ploughs, farm wagons, etc.)
- Holds a license from Harvester, for the disc plough only, which is an antiquated product, of minor importance
- Has 100-110 employees, 35 of these in administrative functions
- Has been operating for 3-4 years with one shift, the equivalent of 30 per cent of its capacity
- 93 per cent of raw materials are produced domestically; only ball-bearings and some specialty steel are imported
- Is not engaged in any repair or maintenance activity
- The production process has undergone some changes: there was once a smelter and forge but, as the demand declined, the process was simplified; today, they are mainly assemblers; there was a reduction in cutting and folding operations
- Exports are irregular and represent between 10 and 30 per cent of production; their destination are the Latin American markets.

Apart from INTERAGRO, estimated to capture half of the implements market, the following firms should be mentioned: APOLO in Medellín, which, although sales are declining, supplies about 15 per cent of the market; MANAGRO in Bogotá with some 10 per cent of the market; Enciso e Hijo, which operates in the Tolima area, specialized in lighter implements used in the rice crops, accounting for an estimated 5 per cent of the implements market.

The remaining firms, with the exception of INTALL, which makes small tractor implements, are all small workshops, most of them located in the Valle region and producing implements that are copies of Rome and Towner.

An important firm operating in the sprayers branch is COLINAGRO. Located in Bogotá, its capital is wholly Colombian and it employs approximately 200 people.

Regarding the irrigation equipment sector, two firms should be mentioned: Ignacio Gomez y Cía. and ALTEC. Both started by producing parts but later developed to make the complete equipment assembly and render technical services.

The hand tools production is mainly concentrated in the hands of three firms: Incolma (employing about 200 people), specialized in matchets; Herragros (over 100 employees); and Herramientas Stanley (approximately 100 employees), with a foreign capital share.

5.3.2 Exports

As shown in table 25, exports of agricultural machinery, implements and tools grew continuously from 1976 to 1981 when a peak was reached totalling $US 7.4 million. In 1981 this amount declined by 11.5 per cent and in 1982 the decline was remarkably sharp: 54.4 per cent. A recuperation occurred in 1984, though only slightly surpassing the 1977 levels.

Table 25. COLOMBIA: EXPORTS OF AGRICULTURAL MACHINERY, IMPLEMENTS AND TOOLS. 1976 - 1984

(US$ thousands FOB)

BTN	PRODUCTS	1976		1977		1978		1979		1980		1981		1982		1983		1984	
82.01	Hand tools	705	(19.3)	882	(22.3)	1,291	(25.9)	1,391	(21.8)	1,600	(25.0)	1,680	(22.7)	1,187	(18.1)	1,427	(47.9)	1,760	(42.8)
82.01.01.01	Spades and shovels	306		382		696		-		236				135		152			
82.01.01.02	Hoes and picks	68		-		130		-		-		= 568		189		109			
82.01.02.01	Axes	54		-		-		372		427				110		131			
82.01.02.02	Machetes	277		500		465		1,019		937		1,112		753		1,035			
84.21		608	(16.7)	207	(5.2)	191	(3.8)	1,464	(22.9)	1,477	(23.1)	1,154	(15.6)	627	(9.6)	287	(9.6)	300	(7.3)
84.21.01	Sprayers and Dusters	608		207		191		1,464		1,477		1,154		627		287			
84.24	Machinery and appliances for soil preparation or cultivation	1,500	(41.1)	1,320	(33.4)	1,257	(25.3)	1,160	(18.2)	1,884	(29.5)	2,292	(31.0)	1,980	(30.3)	233	(7,6)	723	(17,6)
84.24.01.01	Ploughs	271		117		100		-		137		353		-		-			
84.24.01.11	Harrows	111		-		205		189		393		395		255		-			
84.24.02.01	Fertiliser distributors	416		359		104		-		-		-		-		-			
84.24.90.02	Discs	554		700		732		971		1,354		1,407		1,251		233			
84.24.90.09	Others	148		144		116		-		-		137		472		-			
84.25	Machinery and appliances for harvesting, thresting and sorting	488	(13.4)	1,256	(31.8)	1,747	(35.0)	2,371	(37.1)	1,038	(16.2)	1,748	(23.6)	1,353	(20.7)	470	(15.8)	739	(18.0)
84.25.01.01	Mowers	388		883		1,495		2,153		1,038		-		-		-			
84.25.02.01	Corn threshers and others	84		184		-		218		-		1,401		1,130		470			
84.25.04.00	Cleaning machines for grains	16		189		252		-		-		113		-		-			
84.25.05.99	Machines for grading eggs, fruits, potatoes	-										124		223		-			
84.25.90.99	Parts	-										110		-		-			
84.28	Other agricultural machine	45	(1.2)	-		169	(3.4)							398	(6.1)			62	(1.5)
84.28.01.03	Straw crushing machine	45		-		169		-		-		-		398		-			
84.29	Machinery for bread grain milling industry and for the working of cereals	304	(8.3)	284	(7.3)	328	(6.6)			389	(6.1)	518	(7.1)	997	(15.2)	565	(18.9)	526	(12.8)
84.29.01.00	Machinery for mixing, cleaning or preparing grains	36		119		161						-		173		165			
84.29.02.00	Grinding or crushing machinery	268		165		167		-		206		-		-		-			
84.29.04.02	Machines to grir dried leguminous and other			-		-		-		183		518		824		400			
	TOTAL	3,650	(100.0)	3,949	(100.0)	4,983	(100.0)	6,386	(100.0)	6,388	(100.0)	7,392	(100.0)	6,542	(100.0)	2,982	(100.0)	4,110	(100.0)

Source: Departamentc Administrativo Nacional de Estadisticas - DANE.

The value of exports for 1982 (hand tools excluded) compared with the production value in the sector (also excluding hand tools), reached 27 per cent. Although these two variables are not perfectly comparable, the resulting value gives a good indication of the relative importance of foreign sales.

At the product group levels (4 digits, in the BTN classification), no definite trends towards a change in the composition of exports can be seen in the period under study.

The hand tools are a group which, as a result of the increase in the value of exports, shows an improvement of its relative position, changing from about 20 per cent in 1976 to more than twice that share in 1983 and 1984.

The most significant of the specific products are: matchets, discs (for which a drastic reduction in value of exports occurred in 1983), ploughs, harrows, threshing machines and grinding or crushing machinery.

The destinations of exports of hand tools in 1983 were mainly: Ecuador, Peru, Panama and Nicaragua. Other articles were sold to Venezuela, Ecuador, Costa Rica and other Latin American countries.

5.3.3 Imports

The foreign purchases of agricultural machinery and equipment show a growing trend in the period 1976-1982, despite a drop in 1979 and 1980, reaching a peak in 1982 with $US 65.4 million. In the years 1983 and 1984 this amount was reduced to $US 56.8 million and $US 44.2 million, respectively (table 26).

The most important import items are tractors. Throughout the period, they represented between 70 and 80 per cent of the total value of imports.

Table 26. Colombia: Imports of agricultural machinery, implements and tools 1976-1984[a/]
($US thousand CIF)

Heding Subheding Item	Description of Goods	1976	1977	1978	1979	1980	1981	1982	1983	1984
82.01	Hand tools	-	-	-	-	-	-	-	-	102
84.21.01	Sprays	988	-	570	1,751	2,059	2,124	4,950	1,210	1,727
84.24.01	Ploughs	274	377	-	471	667	432	452	-	545
84.25	Machinery and appliances for harvesting, threshing and sorting	7,026	7,881	5,263	4,020	1,013	6,122	6,302	6,876	3,124
84.26	Dairy machinery	144	-	504	-	1,670	1,427	2,335	1,415	947
84.27	Machinery used in wine-making	-	-	-	-	-	-	-	-	73
84.28	Other agricultural, horticultural machinery	315	928	2,180	1,829	1,935	-	1,147	1,103	592
84.29	Machinery used in the bread grain milling industry and similars	746	519	908	2,209	2,463	1,415	1,668	610	1,308
	SUB-TOTAL	9,493	9,705	9,425	10,280	9,807	11,520	16,854	11,214	8,418
87.01	Farm tractors	21,515	32,407	46,646	26,886	42,562	51,009	48,526	45,559	35,773
	TOTAL	31,008	42,112	56,071	37,166	52,369	62,529	65,380	56,773	44,191

Source: Departamento Administrativo Nacional de Estadisticas - DANE.

a/ During 1976-1983 statistics are not available for imports under $US 400,000.

In the remaining groups, machinery for harvesting and threshing accounted for more than half of the total imports, excluding tractors.

As to the origin of imports, the main tractor suppliers are: Japan, Brazil, the United States and Czechoslovakia. The combine harvester-threshers are mainly purchased from Belgium and the Federal Republic of Germany. The remaining products come chiefly from the United States, Spain and Brazil.

5.3.4 Distribution channels

Most of the dealers are representatives of tractor manufacturers and their services are regionalized. The implements industry sells its products through dealers without granting any exclusive selling rights.

The following are the most important dealers: COLCARIE (Ford), MOTOVALLE (Massey Ferguson), DISTRIBUIDORA NISSAM (John Deere, for the coastal area), CASA TORO (John Deere, for the rest of the country), FEDEARROZ - Federación Nacional de Arrozeros (Zetor), COLCARIE (Fiat), and ALMACENES ANGEL.

Some of the above-mentioned dealers also sell industrial machinery. The dealers are paid a percentage over the factory price list: 30 per cent on cash payments and 20 per cent on credit sales.

As far as hand tools and implements (mainly fumigators) are concerned, marketing is carried out through hardware stores and fungicides and pesticides sellers.

5.4 Costa Rica

5.4.1 The development of agricultural mechanization

Agricultural mechanization in Costa Rica dates from the first years after World War II, and is particularly noticeable for the rice[17/] and sugar cane crops, whereas it has developed slowly for other crops, such as coffee. It was only in the beginning of the 1970s that the mechanization process accelerated; this expansion, however, came to a halt in 1978. The economic recession that started in that year has lasted to this day.

The two periods, before and after 1978, are easily distinguished when examining the imports of agricultural machinery (table 27). In fact, during the period 1971-78, an average of 400 tractors were imported per year and harvesters were also bought on a larger scale in those years.

The drastic reduction of imports by the end of the 1970s is partly due to the reduced income of farmers as a consequence of a decline in agricultural production and, later on, due to the substantial devaluation of the national currency.

In 1983, however, this situation started to revert as tractor imports reached 59 units. Information relating to 1984 indicate that, up to August, 275 tractors were imported. So far, based on indicators for the first months of 1985, it is estimated that this recovery is being consolidated.

Nevertheless, the levels of imports in recent years have been barely enough to supply the replacement needs estimated at about 6,500 units for tractors and approximately 300 units for harvesters.

17/ A survey carried out in 1979, in the Pacífico Seco region, showed that 94 per cent of the farms studied made use of mechanical equipment for the preparation of the soil, sowing, and harvesting.

Table 27. Costa Rica: Tractors and harvesters imports, 1971-1984

Year	Tractors (units)	Harvesters (units)
1971	469	...
1972	304	...
1973	350	13
1974	436	7
1975	447	113
1976	364	82
1977	416	-
1978	409	11
1979	213	14
1980	188	7
1981	165	5
1982	63	...
1983	59	...
1884(*)	275	...

(*) January-August.

Source: Asociación de Importadores y Distribuidores de Maquinaria Agrícola.

Table 28. Macro-economic indicators of the Costa Rica economy, changes (per cent), 1979-1982

	1979	1980	1981	1982
GDP variation	4.9	0.8	-2.3	-7.3
Variation of agricultural production	0.5	-0.5	5.1	-4.7
Variation of wholesale prices		23.7	65.3	108.2
Dollar variation (USA)	-	7.8	129.2	87.8

5.4.2 Domestic production

The Costa Rica agricultural machinery, implements and tools industry is very small. This conclusion is reached indirectly, based on a study of imports and, particularly, of exports.

Few products are manufactured: some types of hand tools, some simple tractor implements, trailers, farm wagons, dumping wagons, components for sugar mills, pinion gears for sugar mills, unsophisticated sprayers, dryers for coffee and rice, kilns, etc.

As a rule, the producers are non-specialized workshops producing by order confirmation for the manufacture of machines and parts for various industrial sectors. It is therefore difficult to obtain a profile of the firms in the country. It can be said, however, that the total work force employed in the industry is approximately 300 people.

Based on information from the Asociación de Fabricantes Metalúrgicos (ASOMETAL), the branch 3822 of CIUU (Manufacture of Agricultural Machinery and Equipment) with respect to 1984, had the following characteristics:

- Number of establishments: 5
- Number of employees: 110
- Gross production value: $US 1,306,000.

According to the same source, this branch represents compared to the metalworking sector as a whole: 4.6 per cent of the establishments, 1.6 per cent of the labour force and 1 per cent of the gross production value. These data reflect the limited size of the sector under study.

A list of the most important producers is shown in table 29. As can be seen, most of them are small workshops: three out of the eleven firms in the list have less than 10 employees and three have between 14 and 17 people.

Raw materials are mainly imported and the production process is, in most cases, quite simple: cutting, folding and assembling.

As expected from their small size, these firms are entirely owned by Costa Rican capital and no foreign license is used in their manufacturing process.

Table 29. Costa Rica: Manufacturers of agricultural machinery

Enterprise	Employees	Products
Talleres Industriales Carazo	42	Equipment for sugar production
Taller Industrial Rodolfo Bendix	70	Equipment for coffee production
Taller Mecánico Alfredo Chaves	7	Equipment for sugar mills, trailers
Vulcan Engineering Works S.A.	24	Agricultural machinery
Occidental Inco.	8	Agricultural sprayers
Hnos. Carmiol	16	Parts for industrial and agricultural machines
Xeltron S.A.	25	Electronic units for grain selection
Fábrica Maquinaria Industrial IMECO	5	Hammer mills
Talleres Industriales Poscan	32	Dryers for coffee, rice, kiln, etc.
Fundición Alajuelense	17	Parts for kilns, coffee dryers
Wilmetalind	14	Dryers

Source: Country survey.

5.4.3 Imports

Imports of the agricultural machinery and equipment sector accounted for, approximately 6 to 10 per cent of the total imports during the period 1981-84.

When grouped in large groups, it is noted that tractors, as a group and machinery and implements as another group, have a comparable share accounting for more than 80 per cent of total imports. (Table 30)

Table 30. Imports of agricultural machinery and implements, share (per cent) Costa Rica 1981-1984 ($US thousand)

	1981	1982	1983	1984
Agricultural tools	1,284	1,252	1,607	1,000
	(14.8)	(25.1)	(16.8)	(9.2)
Machinery and implements	3,571	2,119	5,263	4,450
	(41.2)	(42.5)	(55.1)	(40.8)
Tractors	3,822	1,614	2,680	5,452
	(44.0)	(32.4)	(28.1)	(50.0)
Total ($US thousand CIF)	8,677	4,985	9,550	10,902
	(100.0)	(100.0)	(100.0)	(100.0)

As shown in table 31, the most significant imports are: mechanical mowers, harvesters and threshers, as well as cornshellers, huskers, cottonpickers, machinery for sugar cane, coffee and rice, as well as machinery and implements for soil preparation. In the hand tools group, which has a significant and growing share, matchets are prominent accounting for almost half of the imports.

The main import sources are:

- Hand tools: Switzerland, the United States, Malaysia
- Machinery and implements for soil preparation: the United States, Belgium and Luxemburg
- Harvesters-threshers: England and the Federal Republic of Germany
- Others: the United States and Argentina
- Tractors: Federal Republic of Germany, France and Switzerland

5.4.4 Exports

Foreign sales of the products under study are of very little importance. Table 32 shows that they amounted to $US 186,000 in 1980, and $US 233,000 in 1983; in 1984, the data available for the first semester indicate a sharp decrease.

The most important items are grain and fruit pickers and egg selectors and classifiers; cornshellers and huskers; cotton pickers; and hand tools.

Their main destination are Central American countries, particularly Guatemala and Panama.

Table 31. Costa Rica: Imports of agricultural machinery, implements, hand tools and tractors, 1981-1984 (January-August) ($US thousand CIF)

Nauca Classification	Products	1981	1982	1983	1984
699-12-01	Agricultural hand tools	1,284	1,252	1,607	1,000
	Machetes	564	653	898	331
	Others	720	599	709	669
712-01-01	Machinery and implements	746	447	475	922
	Ploughs	104	56	75	96
	Cultivators	24	34	26	13
	Harrows	240	160	136	450
	Planters	68	91	66	105
	Other mechanical machinery for preparation and cultivation land	310	106	172	258
712-02-01	Mechanical mowers, harvesters, threshers, balers, etc.	1,160	524	2,690	1,849
712-02-02	Cornshellers, huskers, cotton pickers, machinery for sugar cane, coffee and rice	1,130	802	1,044	613
712-02-03	Grain and fruit pickers, egg selectors and classifiers	116	56	362	213
712-03-01	Milking machinery	85	41	175	267
712-03-02	Dairy decreamers	4	15	25	92
712-03-03	Other dairy machinery	57	53	84	55
712-09-01	Incubators, breeders	47	61	20	121
712-09-02	Apiculture acces	13	11	10	3
712-09-03-01	Manual grain mills, poultry feeders, etc.	45	6	39	11
712-09-03-09	Other machinery and accesories	168	103	339	304
713-01-00	Tractors	3,822	1,614	2,680	5,452
	Total	8,677	4,985	9,550	10,902

Source: Banco Central de Costa Rica.

Table 32. Costa Rica: Exports of agricultural machinery, implements and tools 1980, 1983, 1984
($US FOB)

Nauca Classification	Products	1980	1983	1984 a/	Major destinations
	Hand-tools				
699-12-01	hoes, shovels, picks and other tools	28,160	3,648	16,535	Guatemala Federal Republic of Germany Panama
	Agricultural machinery and implements				
712-01-02	Cultivators	32,908			Nicaragua Guatemala
712-02-02	Cornshellers, huskers, cotton pickers	34,857	139,551	18,510	Panama Guatemala Honduras
712-02-03	Grain and fruit pickers, egg selectors and classifiers	88,192	89,576	8,170	Panama Honduras Guatemala
712-03-01	Milking machinery	924			Honduras
712-09-03	Other machinery and accessories	809		315	El Salvador
	TOTAL	185,850	232,775	43,530	

a/ January-June.

Source: Banco Central de Costa Rica.

5.5 Guatemala

5.5.1 Agricultural mechanization

Agriculture is a very important sector in the economy of Guatemala, representing more than one fourth of the GDP and absorbing more than half of the labour force, while exports of coffee, cotton and other farm products account for three quarters of total foreign sales.

The degree of agricultural mechanization, as seen in table 33, is however very small when taking into consideration that the arable land area is about 1,850,000 hectares and the country has about 40,000 rural properties.

Practically all agricultural machinery and implements in Guatemala are imported, since domestic production is on a very small scale.

In recent years the consumption of agricultural machinery and implements has declined as a result of a drop in agricultural output, which had a growth of only 1.7 per cent in 1981, followed by a decrease of 2 per cent in 1982 and 2.5 per cent in 1983.

Due to a drop in international prices in 1980 the cotton sector, the largest consumer of machinery, tractors, ploughs, harrows, cultivators, reduced its planted area over the last year to approximately one third of the original area. The demand for machinery and implements was thus seriously affected.

Coffee, which represents about 30 per cent of total exports - although not as mechanized, has also gone through drastic reductions in revenues.

5.5.2 Domestic production

The production of agricultural machinery and implements in Guatemala concentrates mainly on the manufacture of matchets. In the last five years, this represented about two thirds of the production value of the sector. Other hand tools which are produced include hoes, spades, knives, etc.

As far as machinery and implements are concerned, the country produces hammer mills, choppers and grinders, sprayers (except the knapsack type), farm wagons, coffee processing machines, harrows, threshers, manual drills, winnowers, etc.

Table 33. Guatemala: Agricultural machinery and implements in operation, 1979

Item	Units	Number of farms	Proportion on total farms a/
Ploughs (animal)	28,757	19,916	52.9
Ploughs (tractor)	4,863	2,816	7.5
Mechanical cultivators	3,082	1,619	4.3
Harrows	5,020	2,586	6.9
Planters	1,905	1,064	2.8
Harvesters	345	227	6.0
Threshers	489	345	9.2
Corn shellers	1,389	1,265	3.4
Sprayer pumps	36,654	17,883	47.5
Tractors	8,931	3,420	9.1
Trucks	2,848	4,557	12.1
Jeeps and pick-ups	6,238	1,948	5.2
Trailers	13,966	4,173	23.6
Irrigation pumps	3,862	2,274	6.0
Stationary motors (diesel)	5,938	3,532	9.4
Stationary motors (electric)	3,376	904	2.4

a/ total farms: 37,674.

Source: Censo Agropecuário, 1979.

Although a great range of machinery and implements is being produced, this is done on a very small scale and always manufactured to order. Two firms included in a 1981 census survey are given as an example. Together, they employed 63 people and produced 15 harrows, 5 hullers, 87 winnowers and 3 threshers. These factories do, however, receive orders from other sectors as well.

There are only a few manufacturers of agricultural machinery and implements. These are mostly small workshops and several of them are in the rural area. The following are among the most significant:

- COLLINS: maker of hand tools, especially machets
- RESORTES QUICHE: maker of animal drawn implements and parts
- TALLERES FUENTES HNOS.: maker of agricultural machinery in general
- MECANICA INDUSTRIAL AGRICOLA: manufacturers of dryers for grains
- MAQUINARIA AGROINDUSTRIAL S.A.: maker of ploughs, cultivators, weeders, planters, fertilizers, fumigators, trailers, etc.
- AARCO: manufacturer of harrows, trailers, cultivators, etc.
- FUMAGALI: producer of dryers for grains
- MAQUINARIA TOPKI: mainly distributor and manufacturer of irrigation systems equipment.

All these industries, with the exception of COLLINS, are made up entirely of Guatemalan capital and do not use foreign licenses.

Another firm, EMASA, which produced implements for soil preparation and cultivation was operating until a few years ago. This company closed down, due to marketing and management problems and its assets were sold to AARCO.

AARCO is the most modern firm with good prospects. Its principal characteristics are:

- It is divided into two branches: the traditional metallic frameworks division established in 1962, and the new agro-industrial division created in 1984
- Its capital is entirely Guatemalan
- Production is diversified in the agro-industrial division: harrows, trailers, cultivators, hammer mills, choppers and grinders, etc.
- It makes its own models, i.e. copies or adaptations of designs from other manufacturers
- It does repair work, maintenance and produces spare parts
- The industrial process includes all stages, foundry excepted, as it can avail itself of the entire line of the metallic framework division
- The target of the production plan is to reach a total revenue of $US 1.5 million in five years by exporting to Central America and the Caribbean.

5.5.3 Imports

The imports of agricultural machinery, implements and tools underwent a continuous decline in the period 1977-1983, falling from $US 31.7 million to $US 6.2 million. In 1984, however, a significant reversal of this trend was observed, since imports increased by almost 60 per cent (tables 34 and 35).

The reduction in imports is mainly due to tractors, the share of which dropped from 62.6 per cent in 1977 to 28.1 per cent in 1983.

Agricultural machinery and implements (except tractors and tools), also experienced a continuous reduction in the period under consideration, its value decreasing from $US 11 million in 1977, to $US 3.5 million in 1983.

The most important products in the agricultural machinery and implements category are: item 712-02-01 - mechanical mowers, harvesters, threshers, balers; item 712-02-02 - cornshellers, huskers, sugar cane and rice machinery, fibre shredders, coffee mills; and, item 712-02-03 - grain, fruit pickers and classifiers.

Table 34. Guatemala: Composition of imports, 1977 - 1984

Year	Tools	Machinery and implements	Tractors	Total	($US thousand)
1977	2.6	34.8	62.6	100.0	31,725
1978	5.6	33.3	61.1	100.0	27,157
1979	6.6	41.5	51.9	100.0	20,449
1980	7.2	33.9	58.9	100.0	17,859
1981	8.0	38.1	53.9	100.0	15,570
1982	20.0	42.0	38.0	100.0	8,434
1983	15.5	56.4	28.1	100.0	6,155
1984	14.1	48.7	37.2	100.0	9,086

Source: Banco de Guatemala.

Table 35. Guatemala: Imports of agricultural machinery, implements, tools and tractors - 1977-1984
($US thousand CIF)

Nauca Classification	PRODUCTS	1977	1978	1979	1980	1981	1982	1983	1984
	Agricultural Tools.								
699-12-01		836	1,509	1,358	1,291	1,240	1,689	955	1,384
	Agricultural Machinery & Implements	11,038	9,031	8,478	6,062	5,939	3,542	3,473	4,773
712-01-01	Plows	635	662	392	263	130	93	114	139
712-01-02	Cultivators	495	490	446	127	168	4	38	
712-01-03	Harrows	1,625	1,468	583	402	155	65	16	42
712-01-04	Planters	185	290	194	112	128	359	227	198
712-01-05	Other mechanical machinery for the preparation and cultivation of land N.E.C.	450	607	442	251	292	139	273	162
712-02-01	Mechanical mowers, harvesters, threshers, balers, etc.	2,528	1,384	1,988	971	1,926	473	664	1,001
712-02-02	Cornshellers, huskers, sugarcane & rice machinery, fiber shredders, coffee mills	2,945	2,268	2,367	1,444	1,071	785	537	1,035
712-02-03	Grain, fruit, egg pickers & classifiers	264	382	384	502	138	188	417	545
712-03-01	Milking machinery	32	39	38	35	32	5	5	7
712-03-02	Dairy decreamers	18	29	51	57	27	13	19	11
712-03-03	Other dairy machinery	102	87	152	111	126	53	19	362
712-09-01	Incubators, Breeders	189	119	212	169	34	17	281	60
712-09-02	Agricultural accessories	5	29	18	21	7	3	2	2
712-09-03-01	Manual grain mills, poultry feeders,etc.	183	173	415	325	447	424	147	425
712-09-03-9	Other machinery and accessories	1,382	1,004	793	1,272	1,258	921	714	770
713-01-00	Tractors and parts	19,851	16,617	10,615	10,506	8,391	3,203	1,727	3,649
	TOTAL	31,725	27,157	20,449	17,859	15,570	8,434	6,155	9,806

Source: Banco de Guatemala.

According to information for 1984, the most important countries of origin of imports are:

- Hand tools: El Salvador (61 per cent), Brazil (11 per cent)
- Machinery for soil preparation: the United States (32 per cent), Japan (25 per cent), Italy (18 per cent)
- Mechanical mowers, threshers, harvesters: the United States (71 per cent), United Kingdom (27 per cent)
- Cornshellers, huskers, etc.: the United States (34 per cent), Brazil (27 per cent), El Salvador (13 per cent)
- Grain, fruit pickers and classifiers: the United States (79 per cent)
- Tractors: the United States (57 per cent), Mexico (16 per cent), Spain (10 per cent).

5.5.4 Exports

Foreign sales of agricultural machinery and implements have been showing a continuous growth during the period 1970-1978, rising from $US 624,000 in 1970 to twice as much in 1978.

These exports have been restricted mainly to matchets which represented 95 per cent of the total value of exports. In 1981 exports reached a peak and, at the same time, showed a change in profile: foreign sales of matchets decreased drastically, whereas some relevant exports of mechanical equipment for the preparation and cultivation and preparation of the soil and some other items increased (table 36).

It should be noted that all major categories had their share in the increase in exports observed in 1984.

Concerning the destination of exports, the main buyer of matchets is Nicaragua (71 per cent), followed by Costa Rica. As to the remaining items, El Salvador and Mexico are the major clients. Thus, the exports are destined mainly to neighbouring Central American countries.

Table 36. Guatemala: Exports of agricultural machinery and implements, 1977 - 1984, ($US thousand)

Nauca Classification		1977	1978	1979	1980	1981	1982	1983	1984
699-12-01	Machetes	914	1,202	1,070		49	8	48	22
712-01-01	Ploughs	1	1	17		32	-	-	18
712-01-02	Cultivators	-	1	1		-	-	-	-
712-01-02	Harrows	-	1	1		26	-	-	-
712-01-04	Planters	-	-	-		-	-	-	3
712-01-05	Other mechanical machinery for the preparation and cultivation of land N.E.C.	14	19	122		810	420	43	61
712-02-01	Mechanical mowers, harvesters, threshers. balers, etc.	-	-	5		307	-	80	2
712-02-02	Cornshellers, huskers, sugarcane and rice macunery, fiber shedders, coffee mills	9	32	28		10	65	127	-
712-02-03	Grain and fruit pickers, egg selectors and classifiers	-	1	-		27	16	4	-
712-03-02	Dairy decreamers	-	-	-		5	-	-	-
712-03-03	Other dairy machinery	-	-	-		-	-	1	-
712-09-03	Manual grain mills and other machinery and acc.	-	-	10		53	25	-	-
	TOTAL	938	1,257	1,254		1,319	534	303	106

Source: Banco de Guatemala.

5.5.5 Distribution channels and financing

The sales of imported agricultural machinery and implements is carried out through representatives of tractor brands who are both dealers and importers. Before 1977 there were more than twelve agents but now there are less than half that number.

The government grants subsidized credit to farmers but this is mainly for purchasing of fertilizers. The maximum amount of financing is about $US 8,400, an amount insufficient to buy a small tractor (60 HP) with implements, which costs more than $US 13,500. Thus this kind of financing is used only by small farmers for the purchase of minor equipment, for example, a manual or a mechanical chopper (approximately $US 1,000).

The usual procedure to buy machinery is to take advantage of dealers' credit, payable over a period of two or three years, or to get financing from commercial banks.

Machinery and equipment made in Guatemala is traditionally bought for cash.

6. FINAL REMARKS: THE NEED OF A NATIONAL AND REGIONAL STRATEGY TO DEVELOP THE MULTIPURPOSE APPROACH

As previously described the application of the multipurpose approach in the agricultural machinery and implements industry depends upon various prerequisites.

A specific strategy for each country is needed since the situation of the different countries is not homogeneous, neither at the industry development level nor with regard to the facilities they offer for the introduction of the multipurpose approach.

The national strategies should be integrated into the regional strategy, wherever possible, in order to make them more effective.

6.1 National strategies

Briefly, these strategies should include the following stages:

(a) Identification of the type of tool, machinery and implement needed

The mechanization option should be a result of the joint evaluation of a number of variables: crops to be promoted and areas they will occupy, size of properties, type of mechanization currently in use, farmers' income level, impacts on labour use, etc. Especially relevant is the definition of an agricultural mechanization policy in the traditional farming sector.

Based on the above and other variables, guidelines on the most appropriate type of mechanization for the various agricultural operations can be defined, but without specifying the most appropriate tools, machinery and implements.

From these variables long-term estimates on the requirements can also be prepared.

(b) Definition of the technical characteristics of tools, machinery and implements

This stage implies the identification of the most appropriate type of tools, machinery and implements according to a number of variables: the specific function for which it is intended, durability, easy handling, easy repair, cost, availability of raw materials, manufacture technology, etc.

Such an identification is quite complex due to the variables to be considered. It is important to remember that often the tools, machinery and implements in use are not necessarily the most suitable and they merely correspond to what the market has to offer, i.e. imported products or national copies of imported products without any adaptation to the local requirements, as mentioned in the previous chapter. In this context, ICA in Colombia has manufactured several types of animal drawn implements such as: furrowers, seeders, several types of disc harrows, etc. especially for local conditions.

An important aspect at this stage is the research and development capacity existing in each country.

(c) Evaluation of the present and potential supply

This stage would analyze to which extent the national industries are in a position to manufacture (or reduce the cost if they already manufacture) some selected tools, machinery and implements by using the multipurpose approach. This stage is also complex because it requires that the possible constraints be identified and evaluated not only in terms of the technological capacity of the enterprises, equipment, labour, raw material supply, ancillary industries, etc., but also the administrative, financial and commercial capabilities.

The competition of the imported similar products, as well as the foreign market potentials are also important variables to be taken into consideration.

This stage should enable the selection of items that, in principle, could be produced or continue to be made in the country and those that for various reasons could not or should not be manufactured.

(d) Identifying industrial support mechanisms

This stage would aim at analyzing the appropriate incentives to be provided and adapting the industries to the multipurpose approach. The incentives would have to relate both to national and international investment.

Among the incentives to be considered would be for instance: import duties exemption on machinery and equipment, income tax exemption during some years, etc.

The decentralization, especially aiming at locating the enterprises in rural areas, could be stimulated by the supply of land areas and infrastructure free of charge or at subsidized prices.

Another type of incentive would be the guaranteed annual purchase by the government of a minimum amount of the production subject to some norms of standardization, quality control, technical assistance, after sales service, etc. These quantities could, for instance, correspond to the requirements of the agricultural co-operatives or that of the agrarian reform sectors.

(e) Identifying mechanisms to finance the sales of machinery and implements

In order to convert the estimated requirements into the estimated demand, it is necessary that the farmers have financial resources available. There are official mechanisms for this purpose directed to the small and medium-sized farmers in the Latin American countries, but the funds are insufficient and not easily accessible.

6.2 Regional strategy: co-operation

The regional strategy could be an attempt to make the requirements and possibilities of the different countries compatible. Thus, the regional strategy depends on information being available on the national strategies of the countries, so that an overall analysis is carried out, in order to find global solutions for the common problems, and, at the same time, to analyze the complementary areas.

The regional co-operation strategy at the country level could be developed in the following areas:

(a) Distribution of the industries among countries, industrial complementation and raw material supply

This would aim at avoiding the duplication of industries which would manufacture the same products, particularly in the case of neighbouring countries. Likewise, the knowledge of the needs of a group of countries would allow the construction of plants that would operate with economies of scale and at the most appropriate location.

(b) Prototype exchange

Some countries have already developed and tested prototypes that certainly could be utilized in other countries, particularly in neighbouring countries having similar crop characteristics.

(c) Labour qualification

The identification of common requirements in terms of labour recruitment and training can justify the creation or expansion of courses given by international organizations or countries interested in participating in the co-operation programmes.

(d) Centralization of technical assistance from international organizations

Several international organizations provide technical assistance in the design and production of agricultural implements. In Latin America a regional organization should act as central point to exchange information on project development equally adaptable to other countries of the region.

(e) Technology transfer

The more developed countries, being aware of the requirements of the less developed countries as expressed in the national strategies, could provide for technology transfer in different forms, such as production by license, sale of technological package, participation in joint ventures, etc.

A possible way of paying for the technology transfer or participation would be to assure a set amount of purchases of manufactured products for some years.

Another likely scheme could be technology transfer as a compensation for the purchase of machinery and equipment in order to expand the capacity utilization of the agricultural machinery, implements and tools production.

INDUSTRIES SURVEY SHEET

ENTERPRISE ADDRESS PERSON CONTACTED	ACTIVITY	TYPE OF PRODUCTS	OWNERSHIP OF CAPITAL	PRODUCTION	CAPACITY UTILIZATION USED	NUMBER OF EMPLOYEES	EXPORTS	USE OF LICENSE	MAINTENANCE AND REPAIR OPERATIONS	TECHNICAL NATURE OF OPERATIONS
BRAZIL										
Muller S.A. Indústria e Comércio Av.Presidente A.Carlos, 615 Rio de Janeiro Mr.Cilberto Paiva Director	Manufacturer of agricultural and industrial machinery	Agricultural Tractor: 130,140, 220, 25½ and 280HP	100% domestic	Sales(US$million) 1983: 11.3 1984: 40 tractor month 1985: 50 tractor month	50%	950 15 engineers	Few units to Saudi Arabia	No	No	All the operations except foundry and forging
MARCHESAN-Implementos e Máquinas Agrícolas Tatu S.A. Av.Rumablo Antonio, 141 São Paulo Mr.José R.Ferreira Assistant to Director	Manufacturer of agricultural machinery	Different types of disc harrows, disc ploughs, cultivators, scarifiers,seeders, discs etc. and spare parts	100% domestic	Sales(US$million) 1983: 68.3	90%	2.400 25 engineers	US$20 millions approx. principally discs. USA, Canada, Latin America	No	No	All the operations
CEMAG - CEARÁ Máquinas Agrícolas S.A. R.J.Batista Oliveira, 233 São Paulo Mr. José Roberto Prado Assistant to Director	Manufacturer of agricultural machinery	80% mechanical drawn 20% animal-drawn "Polycultor" farm wagons etc.	100% domestic	1984: 7.695 units of differents products Sales(US$million) 1983: 2.1	70%	400 3 engineers	US$50 thousand directly. US$150 thousand by trading co. Bolivia, Peru	FNT-HOWARD for some products	Yes	Cutting (welding machining assembly.
IRMÃOS NOGUEIRA S.A. Máquinas Agrícolas e Motores IRMAG, Comércio e Indústria de Máquinas Agrícolas Ltda. Av.Ipiranga, 1071 Mr.Paulo Nogueira Advisor of Board of Directors	Manufacturer of agricultural machinery	Desintegrators crushingmills farm wagons etc. Coffee dryers etc.	100% domestic 100% domestic	Sales(US$million) 1983: 6.2 ...	80% 60%	380 2 engineers 320	Average 1980-1984 = US$1.5 million	No	No	All the operations
IMPLEMENTOS YAMASHITA LTDA. Av.Anhanguera, km.61 Jundiaí - S.P. Mr. Francisco Cassiauro Director	Manufacturer of agricultural machinery	Machinery for soil preparation: planter seeders etc.	100% domestic	Sales 1984 US$ 300 thousand	60%	35 1 engineer	Experimentally to Paraguay	No	Yes	Cutting, welding, machining assembly
COSTA RICA										
TALLERES INDUSTRIALES CANAZO S.A. Apartado 2297 San José Mr.Carlos E.Canazo Director	Manufacturer of industrial & agricultural machinery	Equipments for sugar mills	100% domestic	Sales 1984 US$500 thousand	80% project to increase the capacity	40/45	Programs	No	Yes	Foundry, forging, cutting, welding machining.

INDUSTRIES SURVEY SHEET

COLOMBIA

ENTERPRISE ADDRESS PERSON CONTACTED	ACTIVITY	TYPE OF PRODUCTS	OWNERSHIP OF CAPITAL	PRODUCTION	CAPACITY UTILIZATION USED	NUMBER OF EMPLOYEES	EXPORTS	USE OF LICENSE	MAINTENANCE AND REPAIR OPERATIONS	TECHNICAL NATURE OF OPERATIONS
INVERAGRO Calle 18, NO 65-B-22 Bogotá Dr.Pompilio Ojeda Director of Marketing	Manufacture of agricultural machinery	Specialized in soil preparation: plough, harrows, farm wagons	100% domestic	Half of the implements market	33% (1 shift)	Total: 100/110 Administr:35 2 engineers	Irregular; 10/30% of production	Harvester (for plough)	No	There was once smelter and forge. Today are basically assemblers; there was a reduction in cutting and folding.
AMAGRO, MANUFACTURAS AGROINDUSTRIALES S.A. Calle 10 no 37-51 Mr.Edgard Cacerres Director	Manufacture of agricultural machinery	discs, ploughs, harrows, farm wagons etc.	100% domestic	10% of the implements market	33%	70 approxim.	A small proportion of sales	No	No	There was once foundry and forging. As the demand reduced the process was simplified. Heat treatment (for discs).
COLDAGRO S.A. Autopista Sur km.4 Bogotá Mr.Lucas Senior Schmal Vice Director of Finances	Manufacture of agricultural machinery Fertilizers	Sprayers & dusters Spare parts	100% domestic	...	80% project to increase 25%	200 approxim.	A small proportion of sales.	No	No	No foundry; stamping is subcontracted. Main operation: cutting welding, assembly.
INDUSTRIAS TECUENDAMA Calle 19 N 4-88 Bogotá Mr.Miciades Castaño Director	Manufacturer of agricultural machinery	Sprayers & dusters	100% domestic	...	50%	...		No	Yes	

GUATEMALA

ENTERPRISE ADDRESS PERSON CONTACTED	ACTIVITY	TYPE OF PRODUCTS	OWNERSHIP OF CAPITAL	PRODUCTION	CAPACITY UTILIZATION USED	NUMBER OF EMPLOYEES	EXPORTS	USE OF LICENSE	MAINTENANCE AND REPAIR OPERATIONS	TECHNICAL NATURE OF OPERATIONS
AARCO ACEROS ARQUITECTONICOS 17 Av. 16-96, Zona 11 Ciudad de Guatemala Mr. Otto Mittelstaedt Director Division Agroindustrial	Manufacturer of industrial structures Manufacturer of agricultural machinery	Ploughs, harrows, farm wagons etc.	100% domestic	Programme 1990: US$1.5 million (basically exports)	Production of agricultural machinery begun in 1985	50 2 engineers	Program	Yes (Santan, Brazil)	Yes	Cutting, folding, welding; basically assembly. Is it a multipurpose approach.
TALLERES FUENTES HNOS 15 Av.41-28, Zona 8 Ciudad de Guatemala Mr.Armando Fuentes Owner	Manufacture and maintenance of industrial and agricultural machinery	Farm wagons, seeders, harrows etc. great variety	100% domestic	...	100%	17	None	No	Yes, very important	Cutting, folding, welding, machining, assembly.

INDUSTRIES SURVEY SHEET

CHILE

ENTERPRISE ADDRESS PERSON CONTACTED	ACTIVITY	TYPE OF PRODUCTS	OWNERSHIP OF CAPITAL	PRODUCTION	CAPACITY UTILISATION USED	NUMBER OF EMPLOYEES	EXPORTS	USE OF LICENSE	MAINTENANCE AND REPAIR OPERATIONS	TECHNICAL NATURE OF OPERATIONS
Soc.Nacional de Comércio-SOCOMCO Calle Nclver 125 Santiago Mr.Rodolfo Kuncar Director	Imports & Exports(main): Manufacture products for construction and agricultural sectors	Farm wagons ploughs	100% domestic	Sales (US$million) 1984:1.0 aprox. 120 farm wagons 80 ploughs	70%	2 engineers ...	None	No	Yes	Cutting, folding, welding, machining assembly
COLOMEISTER Las Rejas 113 Santiago Mr.Ricardo Lessman Director	Imports & Exports(main) John Deere Agent Manufacture products for mining and agricultural sectors.	Ploughs Harrows	100% domestic	100 ploughs 80 harrows	Manufacture begun in 1984	100 (manufacture and maintenance)	None	No	Yes	Basically assembly
ICAT Capuchinos 639 Santiago Mr.Arturo Trentini Director	Construction Transport Manufacture of agricultural machinery (secondary)	Multicultor (estimate of 20 implements)	100% domestic	Production begun in 1985		14	None	No	Production is just beginning	Forging, cutting, welding, assembly
MASKA Alvarez de Toledo 718 Santiago	Manufacture machinery for agriculture (95%) and industrial sectors (5%) Manufacture of spare parts	Dusters & sprayers	100% domestic	1984: 150 tractor trailed boom sprayers	50%	75	No (Just till 1975)	No (Just till 1983)	Yes	Shapping, cutting, bending, welding assembly Smelting is subcontracted
METALURGICA SUDAMERICANA Av.P.de Valdivia Santiago Mr.Rivaros Mourgue Director	Manufacture products for agriculture sector and few products for construction	disc (mainly) hammer mills hand tools	100% domestic	35 t by month	13% (breakeven 15%)	20	Yes: Peru, Equator	Yes (Tauser from England)	No	Cutting, bending, welding, thermic treatment It is a plant with high specialization

For the guidance of our publications programme in order to assist in our publication activities, we would appreciate your completing the questionnaire below and returning it to UNIDO, Division for Industrial Studies, D-2119, P.O. Box 300, A-1400 Vienna, Austria

---

Q U E S T I O N N A I R E

The multipurpose approach to agricultural machinery manufacturing in Latin America

		(please check appropriate box) yes	no
(1)	Were the data contained in the study useful?	☐	☐
(2)	Was the analysis sound?	☐	☐
(3)	Was the information provided new?	☐	☐
(4)	Did you agree with the conclusion?	☐	☐
(5)	Did you find the recommendations sound?	☐	☐
(6)	Were the format and style easy to read?	☐	☐
(7)	Do you wish to be put on our documents mailing list?	☐	☐
		If yes, please specify subjects of interest	
(8)	Do you wish to receive the latest list of documents prepared by the Division for Industrial Studies?	☐	☐

(9) Any other comments?

Name:
(in capitals) .....

Institution:
(please give full address) .....

Date: .....