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RESEARCH ON PULP AND PAPER IN LATIN AMERICA  
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Advisory Group for Latin America

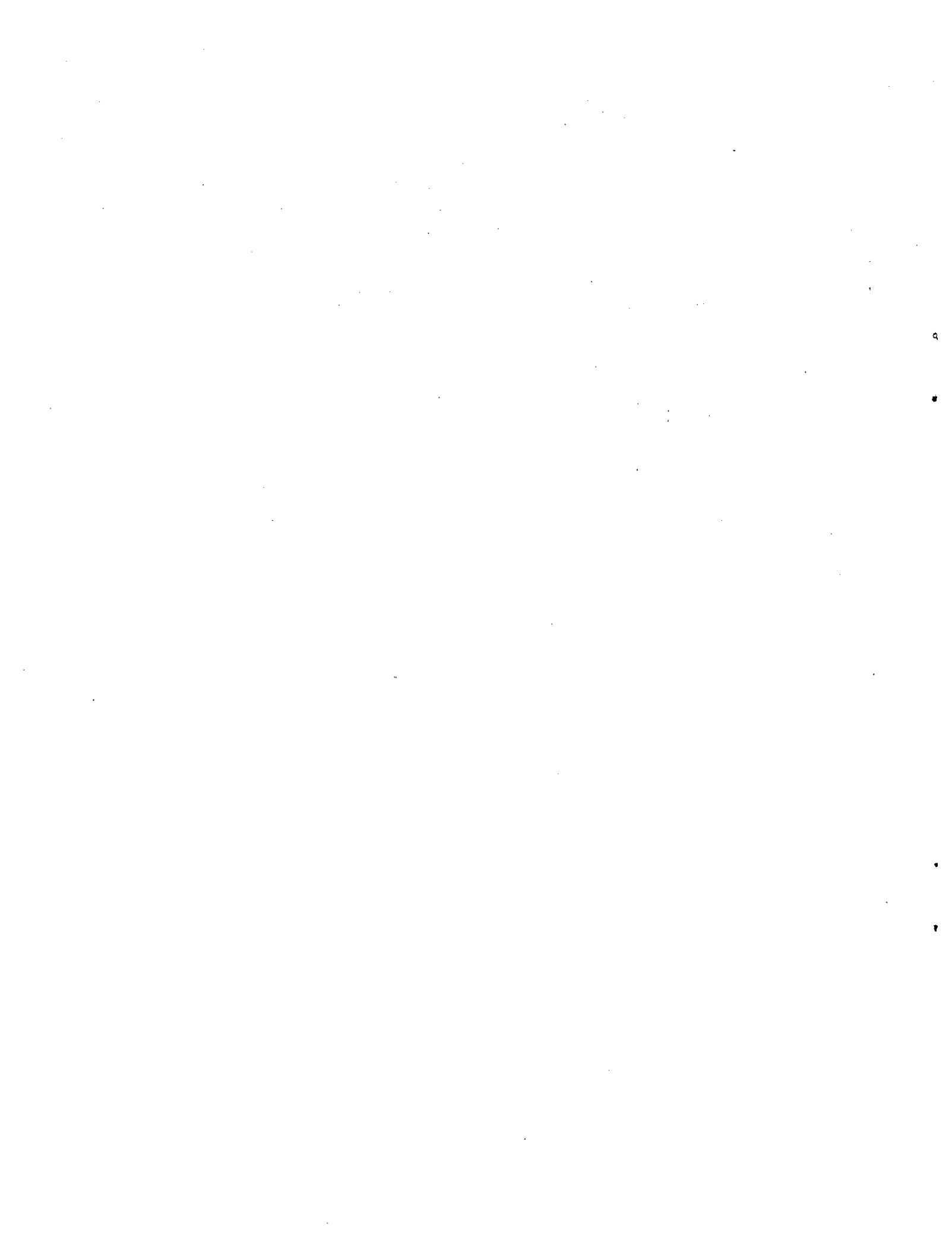
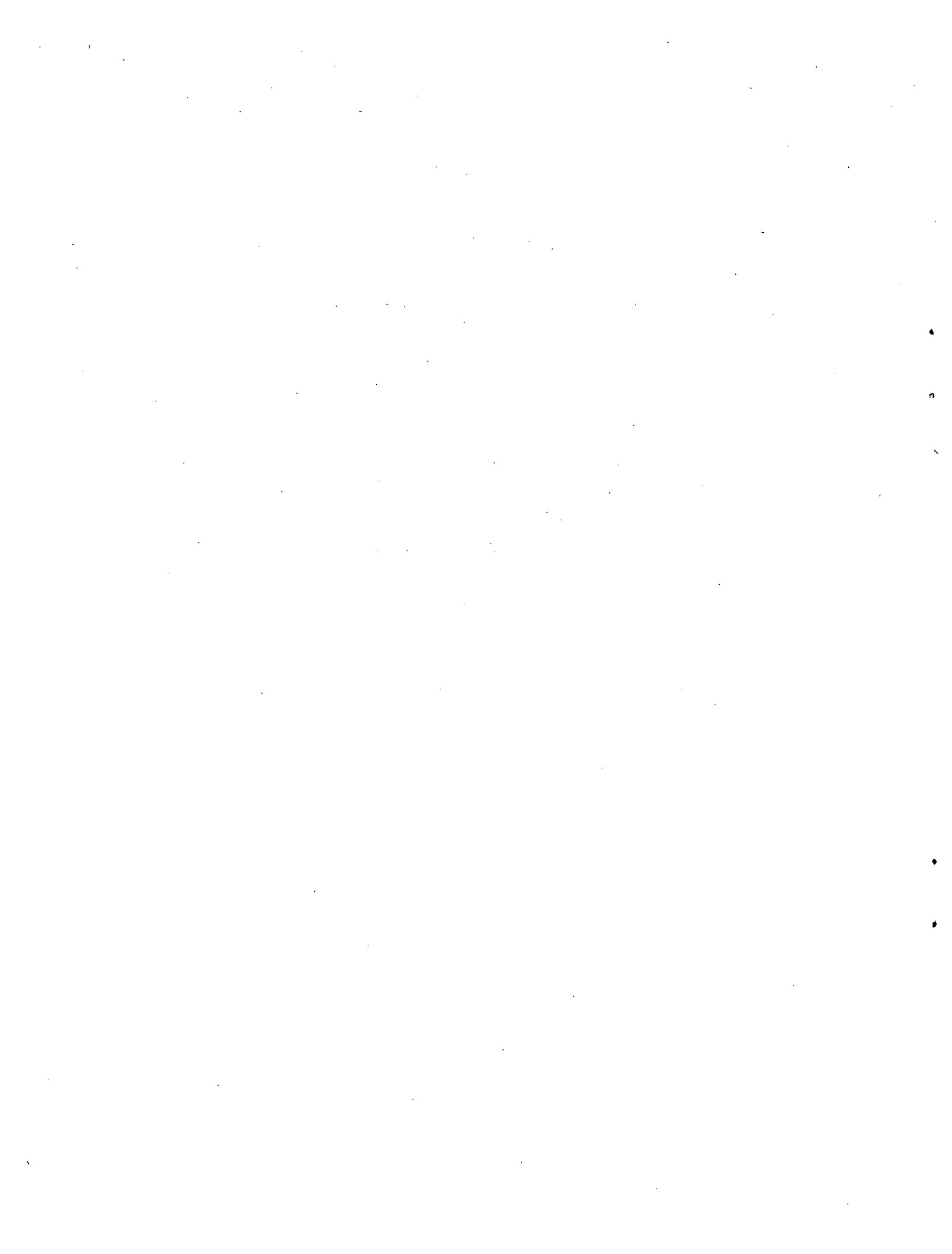


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## RESEARCH ON PULP AND PAPER IN LATIN AMERICA

Summary

Pulp and paper capacity in the region, 2.5 million tons in 1965, will grow to 5.8 million tons in 1975. The increasing capacity of the pulp and paper industry is expected to create a demand for research-related services in the field of pulp and paper technology, services not generally available from the official research institutes at present.

The institutes that do pulp and paper work are in a good position to provide such services to industry against a fee for the work done. A centralized institute is the best possible way of providing these technological services mainly because most pulp and paper mills are not large enough to maintain their own facilities in that respect, yet depend to increasing extent on technological factors in the process of their expansion and modernization.

Research expenditure for Latin America is below the minimum necessary to the industry. Except in Mexico the work now done is not sufficient to attract a steady flow of requests for work on direct industrial problems in pulp and paper. The result is that in many cases the work carried out involves only laboratory pulping, and pulp evaluation on that basis, subjects of little importance to the mills, where production and product problems (paper machine, quality control, stock composition and preparation, coating, instrumentation, etc.) predominate.

The remedy is to permit more government funds to be invested in pulp and paper research facilities (including certain pilot-plan equipment, in accordance with the work envisaged) and at the same time to ensure a closer understanding of the current industrial problems in pulp and paper and the capacity to solve the industrial questions. This implies an accurate "tuning" of the institute to the industrial pulp and paper situation, and that the industry, in turn, appreciates the research and related services made available sufficiently to ensure a flow of requests for work and continuous financing of this side of the institute's activities. For definite research aims of a more long term nature (relating to such subjects as printing performance of papers, disc groundwood from eucalyptus, etc.), co-operative financing is the best solution, whereby research results and possible patents and other benefits go exclusively to the member companies contributing to such research work groups.

Since, in the near future, requests for research and related functions are likely to outgrow pulp and paper research capacity, and in view of other indirect benefits, some degree of regional co-ordination is proposed in order to mobilize better the research resources available, the majority of which are expected to specialize on national problems that may differ from country to country.

/To procure

To procure the funds and personnel for an increased effort in pulp and paper technology, it is suggested that, with industry support in the regular financing of institutional research, expert assistance may be obtained through such channels as international development banks and United Nations, or from bilateral aid programmes of the North American and European Governments.

## 1. Introduction

The Latin American pulp, paper and board industry is in process of expansion and modernization. The introduction of modern equipment and concurrent new techniques is posing a question of technical competence, not as much as emphasized hitherto. The various factors of technical knowledge contribute to different degrees to the efficiency of a modern unit of production. One of these factors is research, and other factors related to research are quality control, instrumentation, know-how and technical skill.

Pulp and paper research has two main aspects: to demonstrate that a process or product is technically and economically feasible, and to help industries in the production stage. These two functions are essential, although they relate to different stages in the development of the industry.

This is not the place to analyse the influence of technical or scientific know-how on the production process. This study intends to emphasize the interdependence of research and production or production planning. Its aim is to evaluate the countries' and industries' relations to research, and it touches on the mobilization of research methods and results for the purpose of production, from the standpoint of quantity and quality.

In this report, the following terms are used as defined below:

Pulp and paper refers to all grades of pulp and groundwood and all papers and paperboards.

Research covers all aspects of pure and applied research, including industrial and pilot plant research. In the context it refers principally to pulp and paper.

Research-related functions include research and development, standards, quality-control, know-how and technical knowledge, instrumentation, technical abstracts and references, technical translations and patents and also technological education and training.

Units quoted are those of the metric system.

Conversion aspects of the production of paper and board products have not been considered.

The Pulp and Paper Advisory Group collected the information on which this study is based in 1964 and 1965. It is believed that it fairly represents the situation, with regard to its subject, corresponding to 1965. The group is indebted to the various research institutes which supplied many of the data and to the many industrial companies that gave their co-operation. The great interest of both groups has made a valuable contribution to this study.

## 2. The Latin American pulp, paper and board industry

The regional pulp, paper and board industry has expanded considerably since the Second World War. From a pre-war output of 300,000 tons (1937), production has risen to an estimated 2.5 million tons in 1965. Projections for 1975 indicate an output for that year of 5.8 million tons.

This expansion reflects the increase in regional consumption that took place during that period. Pre-war consumption, in a much less developed society, was 800,000 tons (1937). Consumption will be 3.3 million tons in 1965 and is expected to rise to 7 million tons by 1975.

Not only has the industry grown with rising demand, it has also diversified, and now produces many of the various grades of paper that a developed society requires. Local products have been substituted for imported ones during the period considered. The substitution process is expected to intensify in the years ahead and only the most specialized products for which there is insufficient local demand will continue to be imported. Wherever the market was fairly large and the supply of local raw materials for the common grades of paper were sufficient, integrated industries have sprung up to supply the products. Such favourable conditions have led to the establishment of large industries, for example in Brazil Mexico, Colombia and Chile, and will no doubt continue to affect their performance in future years. The net result is that the region is becoming more and more self-sufficient in paper and board, and whenever possible in pulp: this is a great change from the earlier period when the region imported so much of its requirements in this field.

Demand and output are growing rapidly, and the quality of most manufactured papers is also improving. Although an exact assessment is difficult, a number of facts, however cautiously interpreted, indicate the improvement. Some examples among many are the consumption data for tissue papers and their ratio of coarse to fine tissues; the growing use of wood content, rotogravure papers; and the increased outputs of long-fibre wrappings and paper bags. The imminent introduction of coated papers and recent installations of offset presses confirm the continuing trend towards higher quality products. The higher output of a wide range of consumer goods, for which a variety of wrappings and box grades are needed point to the same conclusion.

Unfortunately, no recent data are available on the distribution of capacities of paper machines, relative to machine size. It is known that a part of the machine inventory is obsolete by modern standards and unable to produce as efficiently as modern equipment. Obsolete

/machines and



machines and mills, that continue to operate because of tax and other considerations, continue to produce a substantial part of the region's output. This does not imply that old machines have no advantages, but that modern equipment produces more efficiently, and in larger volume and more uniform quality.

New machines and new mills are being built throughout the region. It is generally believed that they can produce a more uniform product at a lower per unit cost. In many cases efficient modern machinery has been installed in the region, but in others the machinery, although new, is built on out-of-date principles. Thus the newness of the machinery is no guarantee of efficiency. As efficient machinery is so expensive, some mills prefer to buy cheaper machinery of less modern design. Such machines are technically acceptable, and may be preferable from the economic standpoint in certain circumstances. But the bulk of such machinery must be regarded as more or less obsolete technically, and such purchases add to the region's problems in achieving efficient and economic production, lowering unit cost and improving quality.

One problem with new, efficient equipment is complicated construction, operation and maintenance. It requires a certain degree of technical skill and knowledge and usually calls for additional training. The complexity of operation of up-to-date equipment and of producing quality products generates a certain interest in technology in the mills concerned. In this respect, as in others, problems of technological training, research and quality control are closely related. Efficient techniques of production, the demand for more uniform quality (combined with higher quality), and the trend towards larger units, further increase the desire for technological know-how, technical training and the research-related factors of quality control, process control, and instrumentation.

Technological factors such as these are undoubtedly becoming a major influence, and in fact affect the day-to-day operation of modern mills. Moreover, the demand for greater technological capacity occurs at a time when quantitative capacity is increasing. The quantity aim (growth of output) exerts a strain on the quality factor which in turn is increasingly felt by the individual companies. Where this situation seems less serious than might be expected, it is usually in the case of smaller mills which have other difficulties, e.g. with their supply of raw materials or with the marketing side, and so are less aware of the technological factors that may contribute to their eventual disappearance. Besides, a growing market will allow the marginal units a longer, though still precarious existence. However, the lack of modern technology is one of the main causes of the disappointing performance of small and obsolete production units. In most cases Latin America's national and regional markets still have ample room, to absorb the output of efficient units,

/and permit

and permit them to increase their share of the market, but the process of weeding out the lesser units is now under way. Pulp and paper manufacture involves highly complex processes and, growing more sophisticated all the time, depends increasingly on technological factors for its survival and expansion.

Yet another characteristic in the spectacular growth of the region's industry must be mentioned. Additions of capacity are concentrated in certain of the continent's sub-areas, and (for paper) follow a pattern which is determined primarily by the concentration of population and industry, and secondarily by the availability of fibrous raw material. Labour costs do not seem to enter much into consideration. This is only natural, since with the single exception of Chile, the industries satisfy local and national needs only. Certain other influences, in some cases quite powerful, can be traced in the development of the industry in certain countries: national planning and control have had, and still have, the effect of regulating, if not determining, the course of its development.

There are striking differences between countries in the industry's development (table 1). On the basis of the availability of materials considered suitable for paper-making, three groups of countries can easily be distinguished: the paper-making, pulp producing and integrated. Argentina is a major paper-making country, Chile is a pulp-producing country and the Brazilian industry clearly tends to national self-sufficiency for both pulp and paper. Brazil still has a majority of non-integrated paper mills, but the situation is favourable to integration of production and this is the aim whenever possible. Mexico, a paper-making country from the outset, is developing its pulp resources to the extent of self-sufficiency, although the question arises whether it can complete that process, in view of the current and continuing expansions of paper-making facilities.

For obvious reasons, Venezuela has long relied on paper imports and only of late has encouraged the national paper industry. The production of pulp is being developed, but need for long-fibre pulp will still have to be met from abroad. Another important example is Colombia, where there is a concurrent development of paper consumption with production, the greater part of which is based on the development of domestic (short-fibre) pulps.

A second division, although difficult to make, is more meaningful with respect to the industry's state of development. It is a division which reveals something about the state of the industry, its history and recent growth, and its degree of obsolescence.

Table 1  
SIZE AND FREQUENCY OF PULP/PAPER MILLS IN SOME LATIN AMERICAN COUNTRIES (1964 DATA)

	To 5 000 TPY inclusive	From 5 000 to 10 000 TPY incl.	From 10 000 to 20 000 TPY incl.	From 20 000 to 40 000 TPY incl.	Over 40 000 TPY	Total number of mills	Total capacity TPY
<b>Argentina</b>							
<u>Pulp mills</u>	<u>11</u>	<u>6</u>	<u>1</u>	<u>2</u>	<u>1</u>	<u>21</u>	<u>193 200</u>
Total pulp manufacturing units, by type of pulp	13	5	1	4	0	23	
Groundwood units	1	0	0	1	0		31 500
Long fibre chemical units	0	0	0	1	0		30 000
Short fibre chemical and semi- chemical units	12	5	1	2	0		131 700
<u>Paper mills</u>	<u>59</u>	<u>18</u>	<u>2</u>	<u>0</u>	<u>2</u>	<u>89</u>	<u>607 300</u>
Newsprint	0	0	0	1	0		40 000
Printing and writing paper	2	4	6	1	1		193 500
Other paper and board	58	15	3	0	0		373 800
<b>Brazil</b>							
<u>Pulp mills</u>	<u>22</u>	<u>10</u>	<u>7</u>	<u>2</u>	<u>4</u>	<u>46</u>	<u>728 600</u>
Total pulp manufacturing units, by type of pulp	36	10	9	2	5	62	
Groundwood units	10	0	1	0	1		166 000
Long fibre chemical units	9	5	3	0	2		220 100
Short fibre chemical and semi- chemical units	17	5	5	2	2		342 500
<u>Paper mills</u>	<u>82</u>	<u>27</u>	<u>16</u>	<u>5</u>	<u>2</u>	<u>131</u>	<u>994 100</u>
Newsprint	9	0	0	0	1		138 450
Printing and writing paper	27	8	5	0	0		192 400
Other paper and board	92	26	6	5	1		663 250
<b>Chile</b>							
<u>Pulp mills</u>	<u>2</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>2</u>	<u>7</u>	<u>247 000</u>
Total pulp manufacturing units, by type of pulp	3	0	2	0	3	8	
Groundwood units	3	0	1	0	2	6	145 000
Long fibre chemical units	0	0	1	0	1	2	102 000
Short fibre chemical and semi- chemical units	0	0	0	0	0	0	0
<u>Paper mills</u>	<u>6</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>2</u>	<u>12</u>	<u>237 400</u>
Newsprint	0	0	0	0	2		135 000
Printing and writing paper	2	0	0	1	0		30 000
Other paper and board	4	2	1	1	0		72 400

/Table 1 (concluded)

Table 1 (concluded)

	To 5 000 TPY inclusive	From 5 000 to 10 000 TPY incl.	From 10 000 to 20 000 TPY incl.	From 20 000 to 40 000 TPY incl.	Over 40 000 TPY	Total number of mills	Total capacity TPY
<b>Colombia</b>							
<u>Pulp mills</u>	<u>1</u>	<u>0</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>4</u>	<u>80 000</u>
Total pulp manufacturing units, by type of pulp	1	0	2	1	0	4	
Groundwood units	0	0	0	0	0		0
Long fibre chemical units	0	0	0	0	0		0
Short fibre chemical and semi-chemical units	1	0	2	1	0		80 000
<u>Paper mills</u>	<u>5</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>8</u>	<u>168 500</u>
Newsprint	0	0	0	0	0		0
Printing and writing paper	6	0	0	1	0		30 000
Other paper and board	5	1	1	0	1		138 500
<b>Venezuela</b>							
<u>Pulp mills</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>1</u>	<u>30 000</u>
Total pulp manufacturing units, by type of pulp	0	0	0	1	0	1	
Groundwood units	0	0	0	0	0		
Long fibre chemical units	0	0	0	0	0		
Short fibre chemical and semi-chemical units	0	0	0	1	0		30 000
<u>Paper mills</u>	<u>3</u>	<u>1</u>	<u>2</u>	<u>2</u>	<u>1</u>		<u>174 500</u>
Newsprint	0	0	0	0	0		
Printing and writing paper	2	0	1	0	0		20 500
Other paper and board	2	1	3	1	1		154 000
<b>Mexico</b>							
<u>Pulp mills</u>	<u>6</u>	<u>1</u>	<u>4</u>	<u>4</u>	<u>2</u>	<u>17</u>	<u>391 700</u>
Total pulp manufacturing units, by type of pulp	10	2	4	5	2	23	
Groundwood units	2	1	0	2	0		68 000
Long fibre chemical units	0	0	1	2	2		199 000
Short fibre chemical and semi-chemical units	8	1	3	1	0		124 700
<u>Paper mills</u>	<u>10</u>	<u>7</u>	<u>2</u>	<u>5</u>	<u>4</u>	<u>35</u>	<u>625 000</u>
Newsprint	0	0	0	1	0		36 000
Printing and writing paper	2	2	5	0	1		145 000
Other paper and board	10	8	5	3	4		444 000

Mexico's policy of state planning is possibly the best example of the orderly planning of a national industry. Without considering the cost of such planning or the financial status of the industry, its technical state and plant-size distribution are among the most advanced in Latin America. This is evident from the distribution of pulping and paper-making capacity, the state of the machinery inventory, the variety of products, and the generally high level of technical personnel. Mexico has a flourishing national association of paper technicians, which has a favourable effect on the dissemination of technical knowledge. Specialization of university students and technicians is encouraged and the industry benefits from the influx of young graduates specializing in paper technology. There is a high level of technical activity in the industry and great interest in the country. The two major Mexican research institutes have pulp and paper departments, and the industry keeps in constant touch with them for technology-related services.

Although of equal age, the industries of Brazil and Argentina have not yet progressed as far, apart from certain modern enterprises in both countries. The ratio of small mills to large is less favourable, and many of the smaller units are obsolete. Diffusion of technical knowledge is less extensive than in Mexico. The technical services of public laboratories, where available, are much less called upon. The larger firms are well qualified in terms of technology, but this is by no means true of the many smaller mills which stand to lose much if technical services remain unavailable or unappreciated by them.

The situation is rather different in Chile, where many small hand-operated units have disappeared over the past fifteen years, and a modern pulp and paper industry has been established, with the aid of international loans, based on locally available long-fibre material with an increasingly large production for export markets within the region. This expansion is likely to continue during the coming years. The industry, apart from the section that meets domestic demand, is engaged in the mass production for export of items that involve less technological difficulties than the products for national consumption. Although the mills are highly sophisticated (continuous kraft pulping, sulphite pulping of pine, chlorine dioxide bleaching, high-speed paper machines), plant sizes seem to indicate that there is no great need for external technological services. Hence, in view of existing and possible future expansions (and the need to compete in export markets), it is understandable that the industry has felt little need to organize public research. On the other hand, there is an urgent need for more and better trained mill workers; so urgent, in fact, that the organization of a mill seminar (to train mill people in process technology) has been proposed.

Public research in Chile on pulping has centred mainly on Pinus radiata. Pulping research has been small in volume, but striking in results. The accumulated experience on pulping of pine has contributed to some of the processes now used in Chilean mills. The main emphasis is on the education of university students and technicians.

/An important

An important aspect of the regional industry is foreign influence. Latin America's situation in the past has, at times, stimulated North American companies and industrialists to establish manufacturing facilities in the region. Their access to technical know-how and facilities for market and technical surveys have allowed them to attain considerable influence in some countries. In some cases, they have pioneered new processes or products (notably in bagasse pulping and banana packaging). Their performance and awareness of production economics has contributed greatly to the region's development in pulp and paper production.

Rather than continuing to import technological know-how as the basis for expansion, it is desirable that Latin American companies develop their own technological abilities to permit future growth to be nourished from within. Such level of technological capacity can, of course, only be attained by the larger companies with adequate financial resources. Such companies do exist in Latin America, but they are the exception rather than the rule. On the other hand, diffusion of know-how and technical capacity can also take place (as it often does in North America) through public research or through industry-sponsored projects, either individual or co-operative.

The major producing countries of Latin America (see table 1) are Mexico, Brazil, Argentina and, to a lesser extent (in tonnage) Chile, Colombia and Venezuela. The major "paper" countries are also the most populated ones. Future development might affect that pattern: Chile, while remaining a small consumer, will develop into the region's major exporter of many grades of pulp, and probably of paper. This development is expected to take place between now and 1975. What will happen thereafter, if other countries also come to develop their potential in terms of timber plantations, is open to speculation. However, it seems reasonably certain that, although Government action originally created the region's public research institutes concerned with pulp and paper, private industry will in many countries gradually become more interested in using the services of these institutes for the benefit of individual companies. This will happen if the institutes now engaged in paper and pulp work at government expense are allowed to take on specific industrial problems, and if they can convince the industry that the quality of their work merits the expenditure. A mutual understanding is needed, as well as a thorough knowledge of the technological contributions to the performance of the pulp and paper industry and its capacity to answer specific questions on technology, economics and other aspects of pulp and paper manufacture. One alternative is for sufficiently large companies (or industry groups) to develop efficient technological resources themselves, either within or outside the companies.

A most important sector of the industry, i.e. the medium-size and small mills with expansion possibilities, has insufficient say in the answers to technical questions which affect their growth. A noteworthy feature in most of these mills is their failure to appreciate fully the

/decisive effect

decisive effect of a major technical decision. Many mills in the past were founded by business people familiar with trade but unfamiliar with technology, and the important decisions on technical matters continue to be made by these people, although their knowledge of pulp and paper technology is usually deficient. Very few mills in Latin America have been nurtured on the tradition of paper-making art, common in Europe. Absence of a proper technical balance and failure to appreciate possible technical contributions have led to the one-sidedness often found in many of the newer mills. However much commercial skills are necessary to the pulp and paper industry, the relative disregard for its technical aspects has helped to create some of the obsolescence found in a number of small and medium-sized mills of recent construction.

The remedy is obvious: it is to concede decisive authority to technical staff so that company decisions are given the proper balance, and are technically possible and desirable. In competitive companies, this is invariably the case, and, for example, participation in decisions by technicians is a routine measure in the North American industry.

The above shows the importance of allowing technical considerations to weigh in decisions on technical aspects of the pulp and paper industry; indeed, pulp and paper manufacturing, as a basis for trade, cannot do without the appropriate influx of technology in the growth of a company. The purchase and importing of knowledge are sometimes necessary for company growth, but are no substitute for the thorough knowledge of technology which is one of the basic factors in the development of the pulp and paper industry today.

### 3. Latin American research centres in pulp and paper technology

Because industrial development in the region is relatively young, interest in applied research could be expected to be of equally recent origin. In fact, most of the research bodies were established after 1945, although a few prominent institutes were founded much earlier.

Most applied research was developed after 1945 because of the scarcity of foreign exchange and because of efforts, at the national level, to produce domestically, commodities for internal consumption. This group of commodities includes products that are manufactured by craft-like industries; i.e. they go through manufacturing steps which, although carried out on an industrial scale, resemble closely the successive steps that characterize the techniques of a craft industry, or even hand work. The properties of such products, though more refined and more uniform in quality, are not basically different from those of craft origin. The industrial process imitates the various manufacturing steps that are characteristic of craft work. Many industrial products are in this craft category, e.g. textiles, leather, foodstuffs, dairy produce, pottery, printing, wood products, and also paper.

The manufacturing steps of these products have remained the same, though improved, during their transition to the industrial scale. It is a characteristic of the craft industries that, while basic research on new manufacturing and product concepts is extremely difficult, the applied aspects of processing and products can be investigated more easily and yield results with more certainty and ease.

For all the easiness of applied research in pulp and paper, little work has been carried out so far. The same applies to certain other craft industries, notably those composed of a large number of smaller units. This is the prevailing structure of much of the paper industry in this region. Research for craft industries is only beginning.

A multi-unit structure, such as that of the regional paper industry, does not by itself encourage the development of applied research. Usually, little or no money can be found for that purpose. It is hard to say whether it is because the gross return on output does not permit the conduct of research, or because complacency prevails. The net result is that some reluctance on the part of the industry prevents funds from being collected for initiating research. A strong industrial association is necessary to overcome this reluctance, and to encourage research generally. Where such associations do not exist, there is often a similar reluctance that prevents the industry from forming groups for a useful purpose. Another cause of reluctance to co-operate with other mills may be the fear of having to reveal mill secrets that might affect the balance of the product market or manufacturing costs. In the modern paper industry, however, there exist few secrets: conditions of production are more liable sources of economies.

In a multi-unit industry, some mills grow rapidly while the majority lag behind in growth or in technology. The resulting industrial oligarchy is no more conducive to industrial interest in research. Large mills can stimulate the creation of a pulp and paper institute and contribute heavily towards it, but the type of research work that is likely to predominate maybe such that smaller members of the industry mistrust the institute and cannot readily absorb the research results.

The large company that dominates the others also has the choice of creating a research or technology department of its own. This action may disturb other mills less, but it does not contribute much to the progress of the industry as a whole. Prospects for co-operative research and technological services within the industry are better if the structure of any association is one of equally powerful units. Unfortunately this is not the rule.

Another reason for the reluctance to spend money on the research work, is a common defect of research in that mills hesitate to spend money on research work that cannot be counted on to contribute to mill performance. Rightly or wrongly, the feeling persists that money so spent is money lost or that the results achieved are not worth the expenditure. While this is often true, it does not apply to all technological work which, though expensive, can certainly justify its cost if properly formulated and reported.

/Hence it



Hence it is not surprising that in Latin America, where the industry is still at such an early stage of development, and is concerned with capital and market problems, no co-operative pulp and paper research, as the intentional result of industrial interest is carried out. The research institutes that carry out pulp and paper work, and those that are planning to establish pulp and paper laboratories, exist because of governmental or national interest and their work is financed mainly by government subsidies. Some have succeeded more than others in capturing industrial interest, as measured by contributions or projects financed by the industry. Most pulp and paper sections of the laboratories described below still depend for much of their activity on official contributions, in exchange for which a variety of work is performed on official request.

The principal research centres of the region are described below in so far as they work on pulp and paper technology and closely related subjects.

### 3.1 Brazil

3.1.1 Industrial research has had a long history in Brazil. The research institute of São Paulo (Instituto de Pesquisas Tecnológicas, or IPT) grew out of a specialized office of materials testing (Gabinete de Resistencia dos materiais), which was then a department of the Polytechnic (Escola Politécnica). This office initiated testing work on building materials in 1925, and a laboratory was created for that purpose.

The Institute was founded as a subsidiary body of the Polytechnic of the University of São Paulo, in 1934, and was given independent status in 1944. While it maintains close ties with the university, it has a separate juridical personality, maintains its own governing board, and has its own budget.

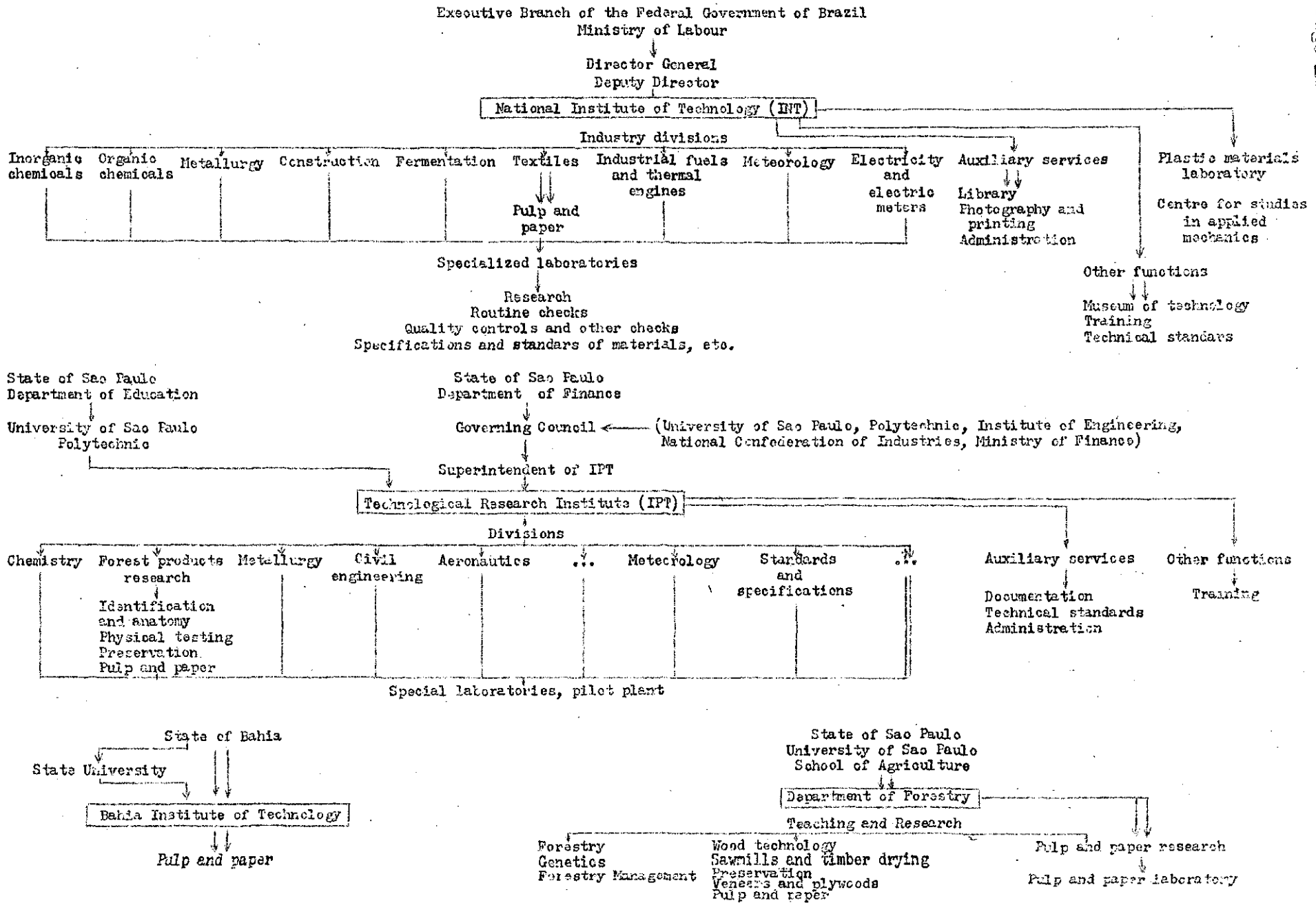
Staff of the Institute perform certain duties as professors at the university. The Institute's total budget is about 600,000 dollars per annum. Two-thirds of the budget come from governmental sources, the remainder from various industries. The Institute has its laboratories on the university campus at Butantán, and maintains its executive office in São Paulo.

The Institute is headed by a Superintendent, appointed by the State of São Paulo, and assisted by the Institute's Governing board, composed of representatives of the State Government, the university, and professionals and engineers from the industrial associations.

Its research (see table 2) include materials testing, technological and analytical work on processes and products, development of standards, and methods for research and for testing. The Institute serves as a training ground for students and postgraduates, advises on industrial problems, and acts as the State laboratory for materials testing. A most important aspect is the Institute's emphasis on pilot plant work at various phases, including process evaluation and the manufacturing in quantity. The Institute maintains a reference library on topics concerning its work.

Table 2

BRAZIL: RESEARCH ON PULP AND PAPER IN GOVERNMENT BODIES



/The Wood

The Wood Division carries out a programme on wood testing and wood properties, and on mechanical and chemical uses of wood. Evaluation of wood species has been a major activity of the Institute from the outset. Notable work on wood testing, identification and anatomy has been carried out, and published at irregular intervals since 1931.

The four sections that now constitute the Wood Division, include one on pulp and paper. It was created in 1956 and carries out the work of a former pulp and paper section within the chemistry division.

The present pulp and paper section deals with problems relating to research into and manufacturing of pulp and paper, and with analytical work on pulp and the testing of pulps and papers. Some of the work is done at the direct request of pulp and paper companies.

The research work and routine analyses are carried out by a full-time staff assisted by auxiliary personnel. Chemistry students at the university and intermediate schools can be admitted for a training stage, and carry out some research work and routine testing of pulp and paper in the course of their assignment.

The pulp and paper laboratory thus serves as a training centre for chemistry students at the university and intermediate levels who are specializing in pulp and paper technology. Technicians employed by Brazilian paper industry can also be admitted for a training stage.

The laboratory is equipped to carry out preparatory and analytical work on pulp and paper. The laboratory has a number of sub-sections, as follows:

(a) Pulp and paper laboratory. The equipment includes a stainless steel rotary digester, various tanks, flat screens, storage vats and a pulp press. It also has a laboratory disc mill, a mixer and a hydrapulper for the disintegration of dry pulp. A small-size fourdrinier and a calender are available, as well as stock preparation equipment.

b) Wet laboratory. A lab disintegrator, a fibre classifier, a freeness tester and water absorption apparatus are available. There are also sheet forming and drying apparatus. A Voith hollander with bronze bars, another Voith hollander with basalt fillings and a Jokro mill are among the beating equipment.

c) Testing laboratory. The testing room is air-conditioned and includes the usual apparatus for determining the physical properties of pulp and paper sheets.

d) Chemical laboratory. An analytical laboratory for the routine chemical analyses of wood and pulp samples.

/(e) Microscopy

(e) Microscopy room. The equipment and experience of the wood-identification section can be used in the work on pulp and paper.

A considerable part of the section's equipment has been domestically manufactured.

As to the work programme, an impressive study has been carried out (and partly published) on the pulping properties of Brazilian wood species. The study has been supplemented by anatomical studies of various wood species performed by the Institute's wood identification section.

The pulp and paper section is financially dependent on the Institute. The Institute is economically dependent on the State Government. Contributions from the industry are received and are allocated to the general budget, not to the Institute's sections and divisions.

3.1.2 Another important institute in Brazil is the Federal Institute of Technology, which is directly dependent on the Ministry of Labour. The offices and various laboratories are in Rio de Janeiro.

The Federal Institute, founded in 1938, had a precursor in the experimental station for fuels and minerals created in 1921. The Institute's activities now cover all important fields of technological research (see table 2).

The Ministry of Labour is the chief source of funds for the annual budget. Approximately 10 per cent of the yearly contributions come from private sources, for consultant and other services. The National Research Council (Consejo Nacional de Investigaciones) has at times made large contributions.

Approximately 100 technicians of various professions are employed in the Institute's nine divisions. They are assisted by 150 auxiliary and administrative personnel.

The Institute carries out technological research on raw materials and products and promotes the use of domestic materials. It can assist the technical sciences and the national industry in those respects. To accomplish these duties, the Institute carries out applied research (new products, new techniques and processes) and routine work to determine product properties. In addition, the institute gives courses to approximately 200 engineering and chemistry students every year.

Further activities are materials testing at the request of private firms or for the Brazilian customs service. It makes control checks on imported materials and on domestic or imported intermediate products which are subject to purchase contracts, customs tariffs, etc. The Institute enforces the national system of weights and measures.

/Another aspect

Another aspect of the Institute's duties is collaboration with the Brazilian Association of Technical Standards (Associação Brasileira de Normas Técnicas) in matters of specifications and standards at the Federal level.

The Textile Industries Division, which encompasses the pulp and paper section, has the necessary equipment for pulping wood material on a laboratory scale, screening and pulp cleaning, classification, and sheet making. The Division has a testing room with apparatus for the routine testing of pulp and of paper sheets. In the analytical laboratory, analyses on wood and cellulose can be carried out.

The laboratory is capable of doing semi-commercial test runs to complement previous laboratory results, and it maintains a pilot plant for the elaboration of cellulose and for paper making, for that purpose. The paper machine is a cylinder machine with presses and a section of steam dryers. Besides, it has an experimental stone grinder capable of yielding pilot test data on the grinding of wood (including data on material and energy balances, power consumption and groundwood properties).

Work done by the Institute includes a major study on the pulpability of various tropical wood species from Eastern Brazil.

The pulp and paper section is staffed by two chemical engineers, three technicians and other personnel, the last ones doing also research work in the field of textile industries.

3.1.3 The State of Bahia maintains a research institute, the Instituto de Tecnologia de Bahia. It is affiliated to the Bahia State University and is financially dependent on the State. The Institute studies a variety of subjects of local interest. In the pulp and paper field, it has carried out laboratory work on the pulping properties of Brazilian hardwood species and other fibrous materials, notably agave. It has a small laboratory for pulping and pulp evaluation.

3.1.4 The Research Institute of the Amazon is installing a small laboratory for research work on pulping and pulp evaluation, principally to investigate the properties of Amazon hardwoods. The equipment is made in Brazil. Only laboratory equipment for routine investigations is involved. The facility is being mounted in Belém.

3.1.5 The State of São Paulo and the paper and pulp industry have drawn up a plan to establish a pulp and paper school, to be located at the University of Piracicaba, 160 km North-West of São Paulo. The school would teach at university and intermediate levels, and would be supported by the State and by the Association of Pulp and Paper Industries. The school's proposed activities would include pulp and paper research carried out by the teaching staff. At the time of writing it had not yet been confirmed that the school would be established.

3.1.6 At present, the forestry department of the Agriculture University at Piracicaba has a laboratory for pulping and pulp evaluation. It is used in connexion with industrial consultation on matters of afforestation, pulp yield per hectare, wood quality for pulping and so on. The consultations are made principally by pulp and paper companies active in afforestation. The main species being planted are eucalyptus, pines, and some others.

The laboratory work of the pulp section complements other work on afforestation and plantation management, carried out in the department of forestry. It is thought that the pulp and paper section is a possible precursor of the school, mentioned above. The initiative for the school was taken by the forestry department of Piracicabas and then seconded by the national association.

### 3.2 Argentina

Although the Argentine paper industry has been well established for a long time, the country has little to offer in the way of paper technology research. Even more remarkable, in view of Argentina's serious lack of fibrous prime materials, is the fact that little organized effort has been made to solve this problem.

Paper manufacturing in Argentina has been affected by economic and political difficulties for some part of the post-war period. Expansion of the industry appears to have been difficult for other than technical reasons, and consequently technological knowledge could make no decisive contribution during that time.

3.2.1 In 1958 the Manufacturer's Association acquired the necessary equipment for a pulping and pulp and paper evaluation laboratory. It was felt that in order to establish a laboratory a working agreement with the National Institute of Industrial Technology (Instituto Nacional de Tecnología Industrial, or INTI) would be desirable.

The formal contract between the Institute and the Association was concluded and the Centre, CICEIPA (Centro de Investigación de Celulosa y Papel), created. The Association has contributed its equipment. The financing of the annual budget has not yet been determined, but the centre begins its activities on a contribution from INTI. The Institute is installing the laboratory and will manage it through a Governing council in which the Association and INTI participate.

The laboratory will begin work on a small scale. It will be staffed and equipped to perform quality control tests of pulp and paper. The work will be supplemented by a programme on pulp and paper problems of interest to the industry. This service will be located at existing laboratory premises of INTI in Buenos Aires. In the future it will be desirable to augment the capacity for laboratory research in order that the industry can be served adequately. Here it is principally the annual budget that

/determined the

determined the capacity of research, and, since the intention is to investigate problems of industrial interest, it becomes necessary to find a form of financing in which the association of paper makers participates by way of annual contributions or through long term contracts.

3.2.2. A technological laboratory is maintained by the Universidad Nacional del Litoral, in Santa Fé. This town, capital of the province of Santa Fé, is located on the Paraná river, 500 km from Buenos Aires. The towns of Rosario (in the same province) and Santa Fé are the regional centres of trade, shipping and manufacturing, and their influence extends through much of the North West and central part of Argentina. The university was founded in 1919, but Santa Fé was an important centre long before.

The technological laboratory is maintained by the chemical engineering faculty and the Department of Industrial Chemistry. The laboratory performs the multiple functions of student training, technological research and consultant services to the industry. The senior staff of the laboratory are in the chemistry and chemical engineering faculty of the university (table 3).

The laboratory's equipment includes machinery for the processing and evaluation of pulp and paper. It carries out technological research, and work on the development of new products and the evaluation of raw materials. The industry may ask the laboratory to carry out research work it deems of particular interest.

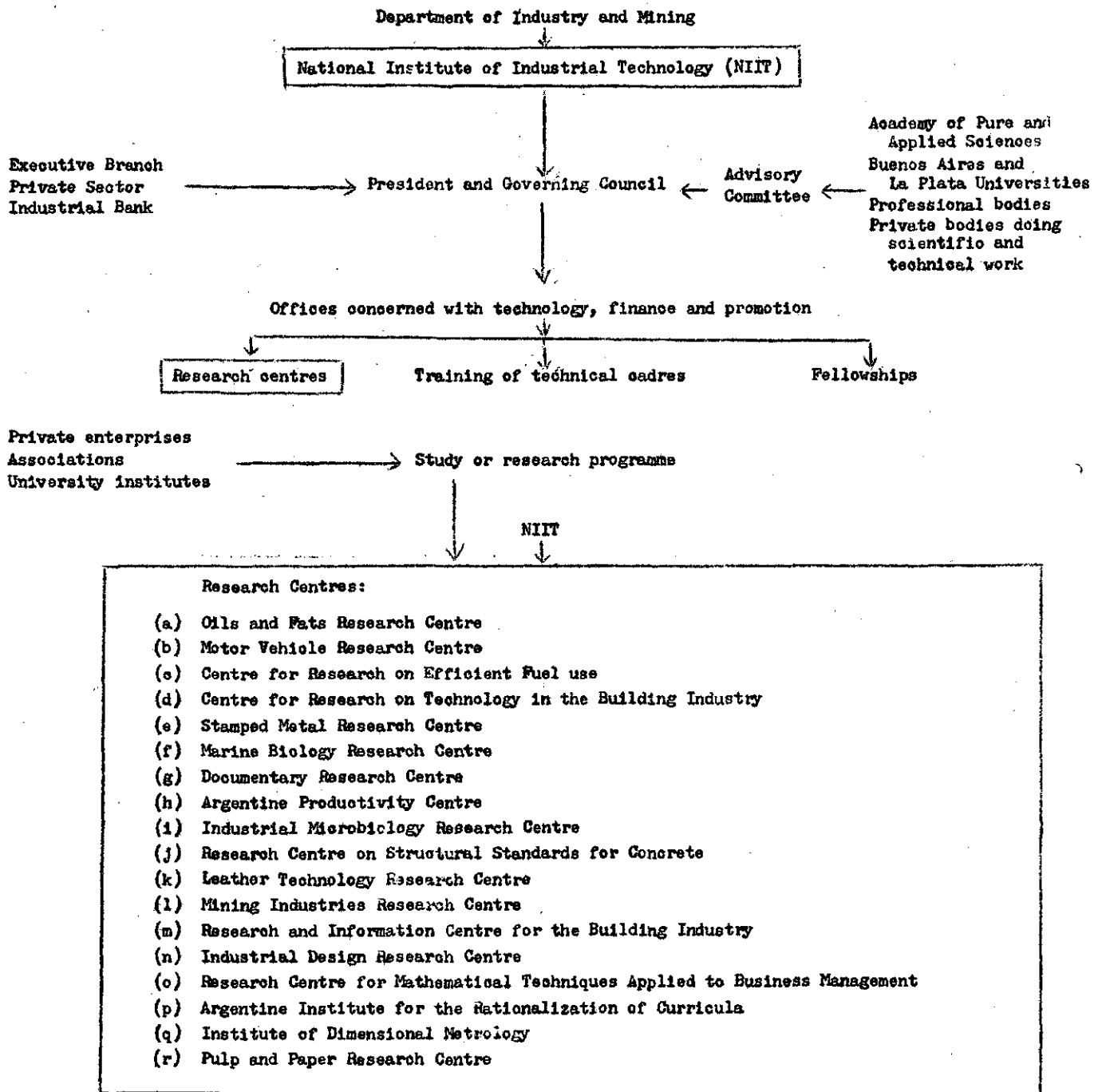
In the course of their studies industrial technology students are obliged to carry out some research work on pulp and paper. The work is done at the laboratory, under the supervision of its staff. Further courses of a non-compulsory nature are planned to begin in 1966. Possibly post-graduate courses will also be given.

Financing of activities at the laboratory, as a part of the chemical engineering faculty, is from the regular annual budget of the university. A new set of internal rules has been proposed for work carried out at the request of third parties. Up to now such research work has been done free of charge.

The laboratory has a rotary digester, kolergang, hollander beater, a fourdrinier of small width and a satinizing calender. A single rotating disc mill has recently been purchased. All the equipment is of a slightly larger size than laboratory apparatus. A testing room for pulp and paper sheets contains the necessary instruments for routine evaluation. The wet laboratory has standard suspension-testing and sheet-forming apparatus.

Table 3

ARGENTINA: STRUCTURE OF THE NATIONAL INSTITUTE OF INDUSTRIAL TECHNOLOGY



/Auxiliary services



Auxiliary services of the laboratory, as well as equipment for other technological disciplines, may be used in the course of a pulp or paper project.

A subsidy requested from the National Council of Scientific and Technical Research is being considered. If granted, it will permit expansion of the laboratory's activities and the installation of new equipment for a modernization programme which is already under way. The new equipment will be purchased and set up during 1965 and 1966.

Various studies (none published so far) have been carried out on raw materials for pulping made available by industrialists, institutes and provincial Governments. A study was carried out at the request of the Uruguayan Industrial Association. Some work on the design of pulping equipment is also being carried out.

3.2.3 The National Forest Administration (Administración Nacional de Bosques) maintains a forestry and forest products research department with laboratory facilities in Buenos Aires. The forest administration depends directly on the Ministry of Agriculture, and the research work is wholly financed by the Ministry.

The research department (Dirección de Investigaciones) has a derived products section dedicated to studies on the chemical utilization of forest products. The section has a laboratory for chemical analysis where wood and bark samples can be studied. There are two other sections of the department, concerned with wood anatomy and physical wood properties.

Various studies have been carried out on the chemical analysis and utilization of indigenous and exotic species for pulp manufacture. Many valuable reports have been published.

The derived products section consists of one chemist, one technician and auxiliary personnel (table 4).

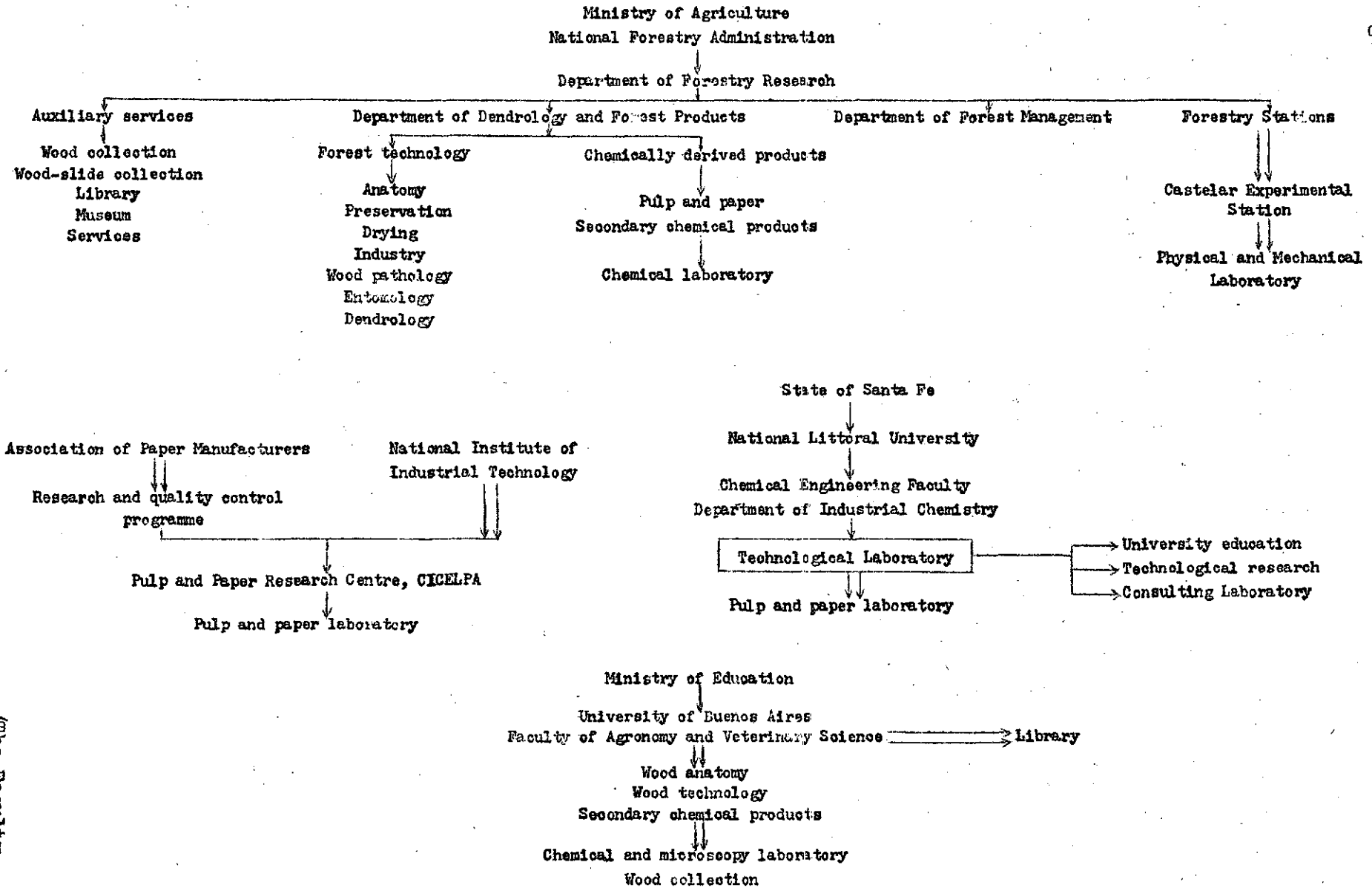
### 3.3 Chile

3.3.1. The natural forest wealth of Chile has not led to any development of forest products research in the country. For example, although the Forest School of the University of Chile has carried out physical testing of indigenous hardwoods, studies on their chemical composition and utilization have been almost completely neglected.

3.3.2 The country's richness of pine plantations, however, has prompted an impressive series of reports on research work, much of it carried out at the University of Concepción.

Table 4

ARGENTINA: LABORATORIES DOING RESEARCH ON PULP AND PAPER AND RELATED SUBJECTS



SI/FCIA/Conf.23/L.6  
Page 20

/The Faculty

The Faculty of Engineering of the University of Concepción maintains a department of forest products which carries out research, inter alia, on chemical utilization of wood and on pulp and paper. The work is done at the Institute of Technological Research, affiliated organizationally and financially to the Faculty, and directly dependent on the University.

The pulp and paper section carries out pulping studies and evaluation of pulp, principally on the basis of Pinus radiata. The Department also carries out research work on the chemical utilization of Pinus radiata wood and bark. Manufacturing economics and feasibility of pulp and paper production have been studied and reported on from time to time.

The section's personnel consists of two engineers and technicians plus auxiliary personnel. Advanced students are encouraged to carry out thesis work, on subjects relating to pulp and paper, for publication.

The pulp and paper section has the necessary laboratory equipment for the processing and evaluation of pulp. Tappi 1/ standards have been adopted.

The equipment consists of the following:

- (a) Pulping laboratory: a stainless steel digester, laboratory size, and pulp reception tanks.
- (b) Wet laboratory: freeness tester, valley hollander, Finnish sheet forming apparatus.
- (c) Testing room: instruments for the routine evaluation of physical and optical properties of pulp and paper sheets. The room is air-conditioned according to Tappi standards.
- (d) Microscope facilities: a microscope, a projector for fibres, a microtome and auxiliary equipment.
- (e) Chemical laboratory: chemical analyses of wood flour and pulp.

In addition the various auxiliary services of the institute are freely available, as is the unit operations pilot plant.

Each year, a few advanced students in chemical engineering receive practical training in laboratory work on pulp and paper and carry out thesis research.

The Forest Products Department belongs to the Engineering Faculty. The Faculty allocates the necessary funds to the Department, which functions as the University's specialized laboratory in forest products.

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1/ Technical Association of the Pulp and Paper Industries (United States).

The work programme of the department, and of the pulp and wood section, is determined annually by the head of the Department, in consultation with the Dean of the Faculty. The Dean is also the Director of the Research Institute.

Occasionally research work is carried out at the request of private companies, who pay for the gross cost of the work.

The Department has considerable experience in laboratory research on Pinus radiata. All work performed has been published or been made available to the industry. Most of the work is carried out as thesis research, the remainder being on items of the yearly work programme.

3.3.3 The University at Valparaiso (Universidad Federico Santa Maria) is enlarging its wood and plastic department and is contemplating the purchase and installation of a pulp and paper laboratory. A new building will be erected to house the pulp and paper school and its installations. The laboratory is primarily intended to contribute to the practical training of students taking a proposed course on pulp and paper technology, at university and intermediate levels. The equipment will include laboratory apparatus for producing wood pulp, evaluation of raw and cellulose materials and routine testing of pulp and paper. Some pilot plant equipment will probably be purchased, e.g. for pulping and pulp cleaning, and perhaps a laboratory or pilot paper machine with auxiliary and stock-preparation equipment.

Although the pulp and paper laboratory is intended for the instruction of students, some time and effort will be devoted to research on pulp and paper subjects that are of industrial interest. Research work and consultations at the request of the industry are encouraged.

#### 3.4 Colombia

3.4.1 The autonomous Institute of Technological Research (Instituto de Investigaciones Tecnológicas) is engaged in applied research on a variety of subjects of national interest. Its work programme emphasizes the processing and utilization of agricultural produce, minerals and food technology. The Institute is sponsored by four national institutions concerned with credit, finance, oil and coffee. They jointly finance a major part of the Institute's budget, and constitute the Board of Directors, which appoints the Principal. The Institute's aim is to help develop the use of national resources, through the introduction of modern and efficient production techniques.

The Institute's annual budget is approximately 400,000 dollars, of which 70 per cent is contributed by the sponsors, the remainder consisting of payments for work performed under contract to third parties, mostly private industry. A small amount of research is carried out at the request of foreign institutions and companies.

/National co-operation

National co-operation in research consists principally of the pooling of equipment. The Institute has a contract for research assistance and exchange with the Armour Research Foundation, and maintains frequent contacts with a number of other research institutions.

The Institute occupies part of two buildings in Bogotá, which are now inadequate for its activities. It is building new premises outside the capital, and will move there in 1965 or 1966.

Staff employed number about 45 university graduates and auxiliary personnel. All staff is full-time, some lecture at the Bogotá universities.

The applied chemistry section is in charge of wood studies: wood decay, wood preservation and physical properties of wood are studied. Some chemical analyses of wood species and other fibrous sources have been carried out.

The Institute has done no research on pulp and paper technology proper, although related work, such as chemical analyses, is done regularly. A few economic studies (e.g. on the national market for fine papers, and on cotton linter use) have been carried out.

Except for its analytical laboratory the section has no equipment for laboratory or technological work on pulp and paper. While the Institute is interested in acquiring such equipment, it has not yet had assignments of sufficient size to warrant its purchase.

No major pulp and paper research work has been commissioned to date by Colombian industry, although analytical testing has been done at their request.

Physical wood testing is carried out by the Institute at the materials laboratory of the national university (Laboratorio de Resistencia de Materiales), by agreement. Identification and anatomy of wood is studied at the Faculty of Forest Engineering, of the District University, also in Bogotá. The head of the Institute's wood section lectures on wood and cellulose chemistry to forestry students at this university. The Institute may request the help of the National Chemistry Laboratory in Bogotá, in its analytical work on paper, boards and cellulose.

The Institute intends to install pulp evaluation equipment, in due course, for studies on national resources for pulp and paper production.

The programme of wood research for the immediate future consists of physical testing of wood species, chemical analyses and further tests on preservation, all in relation to Colombian tropical hardwoods.

Tappi and ASTM standards have been adopted for the analysis and testing.

/Contract work

Contract work for third parties is charged at gross cost for actual work performed, at the request of either national or international bodies. The sponsoring institutions, in addition to their constitutional right to influence the annual work programme, are also empowered to request a certain amount of work free of charge, in proportion to their contributions.

The cost of the programmes on wood testing and anatomy performed at the universities of Bogotá, already mentioned, is borne entirely by the universities themselves. In a few cases tests have been carried out for private companies.

3.4.2 The Forestry Institute in Medellín, part of the National University, plans to purchase basic equipment for pulping and pulp evaluation and use it for teaching students. The educational aim would be supplemented by a wood evaluation programme also covering pulping aspects. It is not known how far these plans are likely to materialize and whether they will be co-ordinated with other pulp and paper research plans.

### 3.5 Venezuela

Wood research in Venezuela began after 1945 in the University of Los Andes in Mérida, and developed steadily after the creation in 1960 of the National Forest Products Laboratory. Although the Laboratory is available for specialized instruction to students of the Forestry Faculty in Mérida, it is primarily a forest products research laboratory for the advancement of wood uses and techniques of wood preparation and processing (table 5).

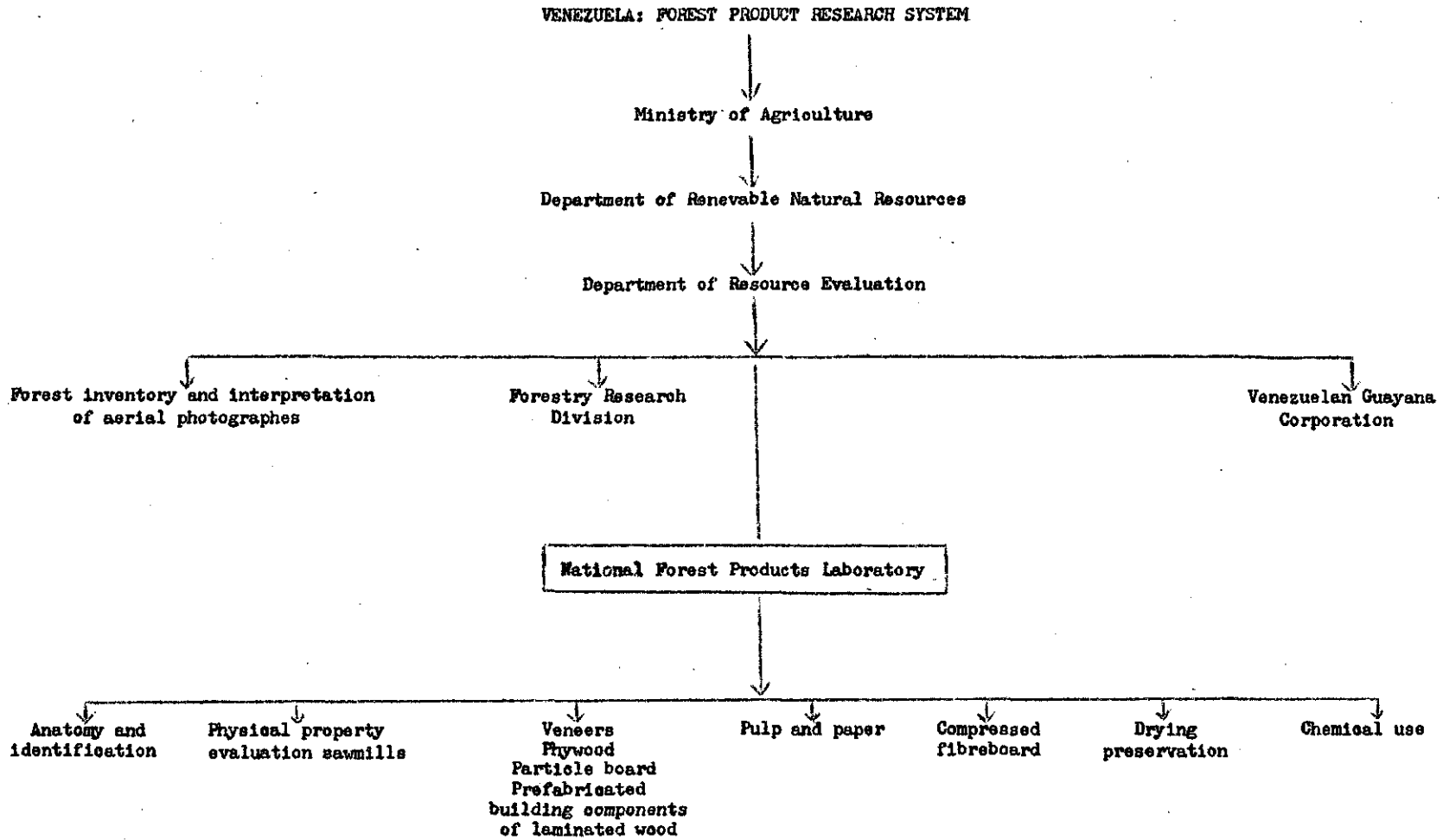
The laboratory is directly dependent on the National Forest Service, a subsidiary of the Ministry of Renewable Resources. The annual budget is determined by the Forest Service, and although some research work is carried out directly at the request of industrialists the work programme reflects the national interest in the development and use of the country's forest resources.

The laboratory engages in all phases of process and product development and evaluation of forest products. It has much specialized equipment for that purpose, as well as complete lines for pilot plant work in most sections of the laboratory.

The Pulp and Paper Division is engaged on the laboratory evaluation of all types of raw materials (with the accent on those of Venezuela) for pulp manufacture. The laboratory can study conventional chemical and semi-chemical processes as well as certain chemi-mechanical processes. It has a limited range of pilot plant equipment.

The Division employs two engineers, and auxiliary personnel. Students from the Faculty of Forest Sciences of the University of Los Andes are admitted for specialized study in pulp and paper, and for research work.

Table 5



/The Laboratory

The laboratory has the necessary equipment for the production and evaluation of pulp on a laboratory scale. For most of the work Tappi standards are followed. The facilities are:

- (a) Wood preparation: a large chipper for hardwoods and chip screening line.
- (b) Pulping laboratory: two stainless steel rotating digesters and four small autoclaves, reception tanks, pulp screening and thickening equipment, single rotating disc mill.
- (c) Bleaching department: chlorine dosing equipment and bleaching tanks for low consistency.
- (d) Wet laboratory: fibre classification equipment, a Valley Laboratory hollander, Tappi and other sheet forming apparatus.
- (e) Testing room: equipment for routine testing of pulp and paper sheets for their most common physical and optical properties (air conditioned).
- (f) Chemical laboratory: equipment for all necessary analyses of pulp and paper, and wood flour samples.
- (g) Pulp preparation pilot plant, washer-thickener, conical refiner, centrifugal cleaners and rotating screen. Additional apparatus (digester, screen, refiner) is to be installed in the future.
- (h) Paper-making room: a hollander and a tabletop fourdrinier.

In addition the auxiliary services of the laboratory are available, and any assistance needed from other divisions, such as testing of physical wood properties and wood anatomy can be obtained.

The staff of the Division, in addition to its present function of helping students with their thesis work on pulp and paper, has started an introductory course on the subject for advanced students.

The laboratory is financed (equipment and annual budget) principally by the Ministry of Agriculture. Some recently installed machines were purchased through the United Nations Special Fund. It is now the laboratory policy to charge according to time spent on all research work carried out at the request of outsiders, either private industry or other government offices.

The Division has now had a number of years of laboratory experience in the evaluation of many tropical raw materials, especially hardwood species. Wood pulping research has been carried out, as well as pulping work on bagasse, grass straw, bamboos and palms. Some of this work has been published on various occasions.



### 3.6 Central America

The Central American countries that form the Central American common market have organized a joint institute for research and industrial development, the Central American Research Institute for Industry (Instituto Centroamericano de Investigación Tecnológica Industrial, or ICAITI). Its offices, laboratories and pilot plants are in Guatemala City. It was organized in 1955, with United Nations assistance, as an autonomous research institution administering its own funds and determining its own annual budget and work programmes (see table 6).

Approximately 75 per cent of its funds come from the sponsoring Governments, the remainder being procured through payments for work done, royalties and donations. The annual budget is approximately 500,000 dollars.

The principal functions of the institute are: to investigate technological problems in the use of raw materials and in manufacturing processes; to deal with production problems of a practical nature; to work on new products; to make market studies and economic analyses of mills; to advise private firms and government offices on industrial questions and on programmes of industrial development, and to introduce new techniques and technology into the participating countries. The work covers a wide range including industrial engineering, technology, chemistry, minerals, geology, economics, pilot-plant production and materials testing. Important work has been carried out in food technology, mineral and chemical products, insecticides, etc. The Institute engages only in applied research, which is considered as more necessary for Central America. Pilot plant research is carried out regularly to check laboratory results on a large scale.

The Institute is counselled by an Executive Committee formed by the Ministers of Economy of the countries concerned, who appoint the Executive Director. The Director reports to the Committee yearly and submits the annual budget and work programme.

Pulp and Paper section. The Institute has recently begun work on a programme on chemical utilization of wood including pulp and paper production. The programme emphasizes problems of utilization of regional raw materials.

A pulp and paper laboratory was installed recently. It includes a testing room for paper, pulp and textiles and is supplemented by an analytical laboratory to carry out analyses of pulp and paper.

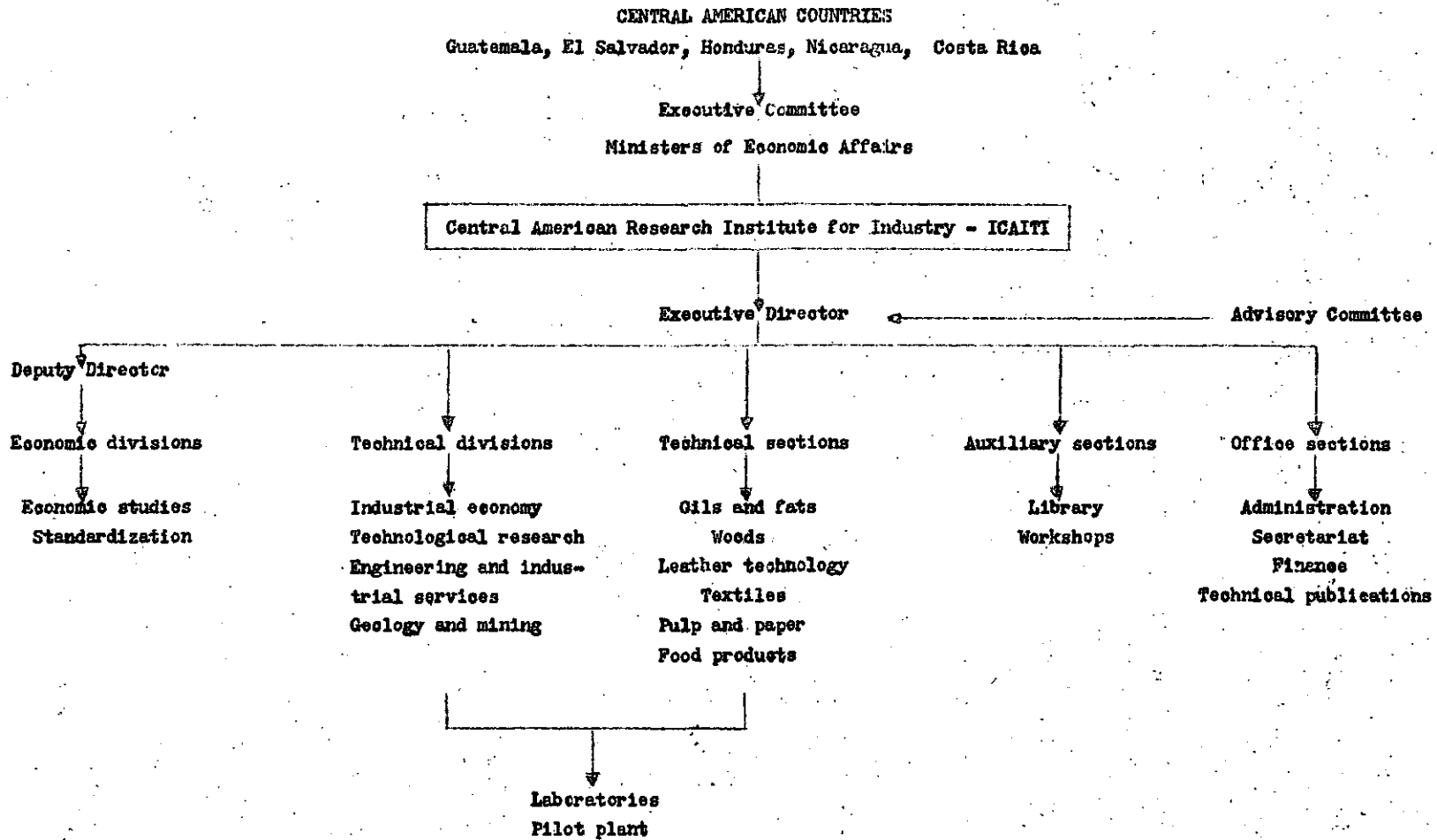
The section now has the services of one chemistry graduate, supplemented by auxiliary personnel from other sections as needed.

The equipment is of German origin and includes:

(a) Wet laboratory: laboratory-size disintegrator, hollander beater, Jokro mill and D.I.N. sheet-forming apparatus.

Table 6

CENTRAL AMERICA: REGIONAL ORGANIZATION OF APPLIED TECHNOLOGICAL RESEARCH



(b) Testing room: routine measurements of the principal physical and optical properties of pulp and paper sheets, as well as textile samples.

(c) Auxiliary services: laboratory for chemical and physical analyses; pilot plant for unit operations and certain special pilot units.

(d) Microscopy unit: microscope equipment is available at the Institute.

The pulp and paper section has been operating since the end of 1964. It was installed to carry out work for certain government offices and for private industrialists.

The section's investment is as yet relatively small. It will be increased according to the requests received and work performed. The same applies to eventual increases in staff. As a temporary measure, staff of other sections will be assigned to pulp and paper if necessary.

Project cost is calculated as the gross cost to the Institute. On this basis projects from private enterprise are carried out as well as projects from sources outside Central America. Some work, not related to pulp and paper, for Caribbean countries has recently been done on this basis.

The pulp and paper work is carried out in accordance with Tappi standards.

Before the installation of the pulp laboratory the Institute completed two major regional reports on pulp and paper. The reports are on technical and economic matters and involved no laboratory work.

Some minor requests on mechanical wood use were investigated and reported on during the recent years.

### 3.7 Mexico

3.7.1 The National Laboratories of Industrial Development (LANFI), created in 1948 by the Government as an autonomous institution, is organized as a non-profit-making body, with its own capital and juridical status. It was set up at the Government's initiative, as part of its long-range plan to develop national industry.

The laboratories were established by legislation to work on scientific and technical research of industrial applications with the following aims:

(a) To determine the characteristics of raw materials that national industry requires and to determine the properties of industrial products of domestic origin,

/(b) To

- (b) To study processes and new forms of exploitation for natural resources and derived products,
- (c) To find new applications for raw materials and derived products,
- (d) To solve industrial problems that require laboratory investigation,
- (e) To make their services available, under contract, to industrial or commercial enterprises or to government offices,
- (f) To carry out work on methods for the standardization of industrial products and processes,
- (g) To initiate research in the various fields of pure science relevant to the solution of industrial problems,
- (h) To carry out experiments and analyses in general, and every type of laboratory work, to assist industry,
- (i) To determine the main intermediate, contributory and complementary sectors in Mexican industry, that should be given preference,
- (j) To provide arbitration services in cases referred to by third parties,
- (k) To carry out any activity relating to the above-described aims.

The laboratories began to function in 1950. Two types of activities have since emerged: applied research, which is carried out in the laboratories themselves, and technical services to established industries and enterprise. The organization of the laboratory is outlined in table 7.

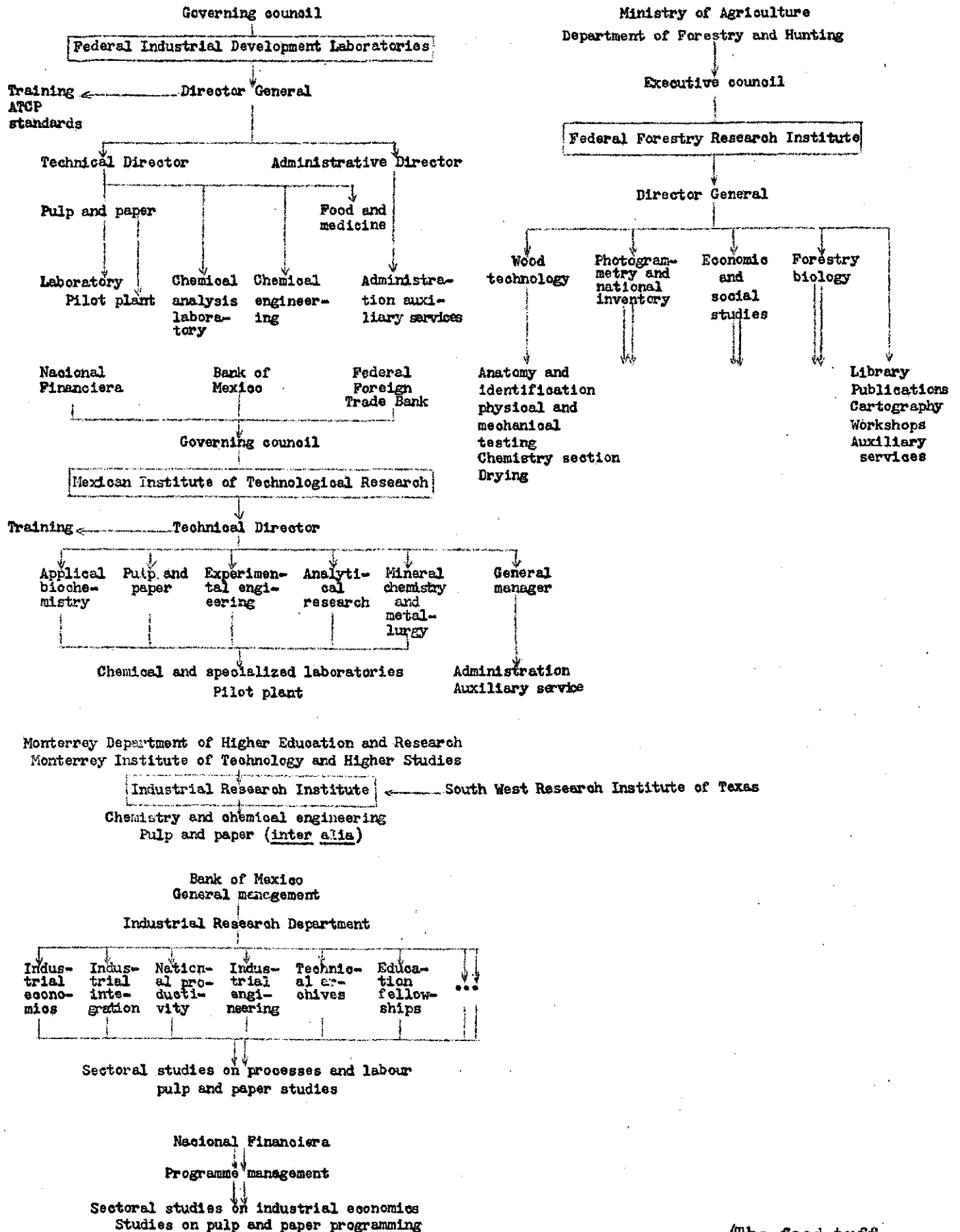
The annual budget is financed by a government contribution and through payments for work performed. The legislation establishing LANFI authorizes it to seek patent rights, which may not however be exploited in direct form.

LANFI draws up its own work programme and annual budget. The Government does not have control over the laboratories or its various projects, or its research work. Work carried out for companies at their request is confidential. LANFI generally publishes the results of its research work, unless it is of a confidential nature.

The analytical chemistry unit deals with a variety of problems, such as water analysis, analyses of metals, minerals, oils, fats, paraffins, etc., and of composite materials. The analytical unit, in co-operation with the National Commission on Nuclear Energy, has embarked upon a number of studies relating to industrial applications of radioactive isotopes.

Table 7

MEXICO: FEDERAL AND OTHER GOVERNMENT AGENCIES FOR RESEARCH ON TECHNOLOGY AND INDUSTRIAL ECONOMICS



The foodstuffs and medicines section is now engaged on an important study on the use of certain plants from the Mexican desert zones as food. In addition this section provides technical services to the pharmaceutical, food and beverage industries. A new process of continuous fermentation for yeast production has been developed.

The chemical engineering unit, besides co-operating with other sections on questions of unit operations and processes, or production costs and market studies, is now engaged in developing certain projects relating to the use of by-products from the sugar industry. The unit also makes its technical services in chemical engineering widely available to industry in general.

The pulp and paper section constitutes the original basis of LANFI. It now provides extensive technical services to practically all the national pulp and paper mills, ranging from the most simple laboratory tests to full-scale research on raw materials and processes and pilot plant follow-ups.

The section has concentrated much of its own research activity on the study of raw materials other than wood that grow in the arid zones of Mexico, for the production of cellulose.

The section offers a variety of services, relating to the evaluation of fibrous materials, pulp, paper, composition products and all types of fillers and auxiliary substances used in the manufacture of paper.

The section also provides technical training for industry personnel, and courses of specialization to students.

In general the graduates of institutions of higher learning are not well informed on specific technologies. In the case of specialization in pulp and paper, it is particularly important for companies to have qualified technical personnel who have graduated recently, because they have been trained in the interpretation of analytical results, either physical or chemical. Experience has shown that the training of a technician in the mill itself is an expensive affair and takes about a year, whereas similar training can be obtained in accelerated form and at less cost in institutions such as LANFI. Many students from the university and the Polytechnic take a practical course at the various sections of this institute.

The pulp and paper section has a professional staff of chemists and chemical engineering graduates, most of them from the National University (Universidad Nacional Autónoma de México) or from the Polytechnic; there is also a body of consultants and advisers, both Mexican and foreign.

Many chemistry and chemical engineering students in their last year at the university use the pulp and paper section for experimental work in completing their thesis. This work period lasts about a year and includes

/elementary courses

elementary courses on the use of laboratory apparatus, on methods and procedures and, of course, on work on the subject of the thesis. Each year about 5 students are admitted for pulp and paper training.

The section has the necessary equipment for laboratory work on the evaluation and chemical analyses of raw fibrous materials, on pulp preparation and evaluation, on paper manufacture and on all types of testing of pulp, paper, etc. In principle Tappi standards are applied.

Furthermore, a large pilot plant for the production of bleached and unbleached chemical and semi-chemical pulps is included in the section's equipment.

The following equipment is available:

(a) Pulping laboratory: a battery of small autoclaves, three rotary digestors of stainless steel, reception tanks, three diffusor-washers, screening gear, a pulp press, storage tanks, and a small disc refiner.

(b) Bleaching laboratory: apparatus for the usual bleaching experiments on a laboratory scale.

(c) Wet laboratory: disintegration and fibre-classifying equipment, freeness tester, two laboratory hollanders and a lamphen mill, Tappi sheet-forming apparatus.

(d) Paper machine: a table-top fourdrinier with auxiliary gear.

(e) Testing room: a complete line of apparatus for physical and optical evaluation of pulp, paper and board sheets.

(f) Chemical laboratory: analyses on samples of wood, pulp, paper and paper products, and additives.

(g) Microscope room: microscopes and auxiliary apparatus, fibre length measuring apparatus.

(h) Pilot plant for pulping: a semi-commercial unit to produce chemical and semi-chemical pulps by alkaline and neutral processes, and for pulp bleaching. Wood preparation equipment is included. The plant's capacity is 300 to 600 kg of chemical pulp (oven dry basis) per charge. It has its own liquor make-up system, liquor tanks and diffusor-discharge. Auxiliary equipment includes mixing tank, sand traps and screening stage, bleach hollander, rotary filter and a wet lap machine. Pulp is obtained at 30 per cent dry. For paper-making trials the laboratory arranges for the pulp to be sent to a nearby paper mill, where runs can be made under the supervision of LANFI.

Investment in pulp and paper equipment totals about 100,000 dollars.

/The results

The results of research work carried out in the pulp and paper section are usually published in Mexican technical magazines, unless there is a contractual restriction.

The laboratory carries out most of the work necessary to develop and perfect national standards, which relate mainly to product quality.

3.7.2 The Mexican Institute of Technological Research (Instituto Mexicano de Investigaciones Tecnológicas, or IMIT) is one of the country's principal research centres. It was created in 1946 by the Bank of Mexico, and started its activities in 1950. It grew out of certain advisory work being done within the Bank of Mexico. Its primary aim is to provide the country with adequate services in industrial research, in order to help promote the development of its natural resources. It is concerned mainly with the use of natural resources, and carries out applied research, continued to the pilot plant stage where appropriate.

The Institute is sponsored by the Bank of Mexico, Nacional Financiera and the National Bank of External Trade. It was founded after a comprehensive study of industrial development by the Central Bank, according to the recommendations of the Armour Research Foundation, of the Technological Institute of Illinois. Up to 1954 Armour Research directly influenced IMIT's development, and since then has continued in a consulting and advisory capacity, through an agreement with the United States Government.

IMIT's budget is provided by its three sponsors and by funds from firms and organizations, contributed in return for IMIT technical assistance. The sponsor's funds are used for research on new techniques, and, in particular, for the conducting of numerous projects of national interest. Part of these funds are used to maintain annual training programmes for students and research workers. Some of the funds are also used to further research on projects originating with private industry, and carried on as co-operative projects.

Where necessary project work is carried on to the final stages of design and process engineering. Pilot-plant runs are conducted if necessary for calculations or design. Studies of a complete project can include such items as process design, energy and materials balance, flow diagrams and economic data on raw materials, operating cost, market studies and an indication of possible plant locations.

Much of the work carried out at the request of industry touches on one or more of the specific phases between a routine control test and other laboratory work, and the final stage of pilot plant and engineering aspects.



One of the important functions is the training and specialization of research workers. All staff of IMIT have at one time or another followed specialized courses abroad. IMIT also has an educational function in that it accepts students from Mexican universities and the Polytechnic for training in the practical aspects of laboratory, pilot plant and industrial research and gives courses in the various fields covered by IMIT. Such work is usually for the purpose of preparing the thesis that completes the students' university education, although in some cases industry personnel are admitted. IMIT can also grant post-graduate fellowship for further specialization abroad to some of its alumni, and this is done regularly.

IMIT carries out work in eight sections (see table.7). Its laboratories are very well equipped, and the many installations in the pilot plant and unit operations hall are impressive.

The pulp and paper section does analytical, testing and evaluation work on pulp and paper and is equipped for laboratory work on pulping and paper-making. Most of the work now carried out originates from individual requests by industry. It ranges from routine checks to laboratory evaluations and to the economical or technological aspects of pulp and paper production. Some important work involves pilot plant runs. IMIT has a pilot plant for pulping and bleaching runs on wood, bagasse, etc. The plant was originally designed for chemical pulping runs of the acid processes.

The section employs two university-level engineers and four technicians, plus auxiliary personnel.

Approximately four or six graduate students specializing in pulp and paper technology follow the institute's courses every year and prepare a thesis on subjects determined by the staff.

The necessary equipment for laboratory pulping, pulp evaluation and pulp and paper testing is available and Tappi standards and procedures are followed throughout:

(a) Pulping laboratory: stainless steel digester, set of small autoclaves; screen and reception tanks, mixing facility, single rotating disc mill.

(b) Bleaching laboratory: apparatus for laboratory studies on bleaching and the facility of running bleach studies in the pulping laboratory.

(c) Wet laboratory: pulper and disintegrator, classification apparatus, freeness tester, valley laboratory beater and Tappi sheet-forming apparatus.

/(d) Testing

(d) Testing room: all necessary apparatus for physical and optical testing of pulp and paper sheets, microscope and auxiliary instruments.

(e) Chemical laboratory: usual analyses on wood flour, pulp, paper samples and paper products.

(f) Pilot pulping plant: a complete line for the chemical pulping and bleaching of fibrous materials, with a capacity of 100 to 2,000 kg per 24 hours. All equipment usable with acid processes. The plant includes liquor make up and deposit, pulp tanks, screens and cyclone gear, rotary washer, chlorination tanks and high density storage. Stainless steel digester of 1.5 m<sup>3</sup> capacity.

(g) The auxiliary services of the institute are available, as are the unit operation and pilot plant installations of other sections.

IMIT's pulp and paper experience is considerable: it has studied the pulping qualities of straws, bagasse and mixed tropical hardwoods. It holds a key patent on a process of pulping mixed hardwoods which was developed to the pilot plant scale in IMIT. Furthermore, its experience includes general evaluation and testing work, bleaching problems, pulp and paper products, quality and control work and analytical tests.

A major part of research work is of confidential nature, carried out for third parties. Certain work is published. The Institute publishes all student theses.

3.7.3. In the north of Mexico there are a group of institutes which contribute greatly to industrial progress (table 7).

The Institute of Industrial Research (Instituto de Investigaciones Industriales, or III) was founded in 1951 by the Foundation for Higher Education and Research (Enseñanza e Investigación Superior A.C.), which also founded the Institute of Technology and Higher Studies of Monterrey (Instituto Tecnológico y de Estudios Superiores de Monterrey, ITESM). This research institute was sponsored by ITESM, with the collaboration of the South West Research Institute of San Antonio, Texas, to which it is affiliated. It was created as a non-profit institution, to provide services in applied research for Mexican industry. The Institute is wholly free of any industrial or government influence and is maintained principally by payments from firms for projects carried out for them. Its essential work is research in the field of chemistry and chemical engineering.

The Institute has done some pulp and paper studies, inter alia on the development of specialty papers. It has a laboratory with certain routine equipment for pulp evaluation, i.e. a Valley beater, sheet-forming apparatus etc.

3.7.4. The National Forestry Research Institute (Instituto Nacional de Investigaciones Forestales, or INIF) is widely known for its forestry research and forest products evaluation. Its forest products work is mainly on mechanical utilization: physical wood properties, preservation, drying, etc. (see table 7).

The Institute is the government laboratory for forestry research. It is maintained and sponsored by the Ministry of Agriculture, through the Department of Forestry. One-fourth of the Institute's annual budget is contributed directly by the government, and the remainder comes from various official and industrial sources, in the form of contributions and fees for work carried out.

The Institute has no intention of entering the field of pulp and paper research, especially since two Mexican institutes of high standing are active in that respect. It has, however, created a wood chemistry section to carry out research and evaluation work on the wood and bark of Mexican species. A laboratory for wood chemistry and chemical analyses of wood species is being installed.

The Institute has a section of wood anatomy and wood identification which is fully established and well equipped with microscopes and auxiliary apparatus. It has a staff of two technicians. It has studied the anatomical properties of several Mexican wood species and is publishing the results, while further work is being carried out.

Both the above sections are part of the Institute's Division of Wood Technology.

### 3.8 Studies of other character

Hardly any work on pulp and paper and related fields is carried out outside the above-mentioned institutions. It may be that occasional research has been done at other universities, but it has not contributed much to the region's general progress in this field.

Nevertheless, some interesting aspects of institutional work on pulp and paper economy and feasibility are worth mentioning. The fact is that after 1945 many countries, finding themselves short of paper, provided incentives to boost domestic production and carried out and published studies on the economic aspects of pulp and paper production, through their specialized agencies. The remarkable thing, of course, is that these studies were mostly divorced from the complementary aspects of production or research technology generally included nowadays. It was apparently felt that feasibility studies and the economics of pulp and paper, being of prime importance to the nation, constituted a separate urgent task requiring action, rather than the whole complex of technique and economics. The new approach reflects the changing needs of the industry today and the present interest in technology, now that the paper industry in most countries is well beyond its infancy.

In Mexico's postwar development plans, such studies have greatly influenced the economical development of its industry. Various institutions directly dependent on the Government have carried out such studies. Among these the Bank of Mexico and Nacional Financiera have played a major part.

/The Office

The Office of Industrial Research of the Bank of Mexico has emphasized, (ever since its creation in 1941), national productivity, industrial economics and integration of the various sectors of Mexican industry. Its work is related to the technological work at IMIT.

Nacional Financiera has a similar economic studies section which has shown a continuing interest in the development of the paper industry. In addition to advising the Government, Nacional Financiera has also exercised its right to participate financially in national industries, and has more than once done so in the paper industry.

An extensive study on the economical feasibility of pulp production for export has been made by the Central Bank of Honduras. The study followed international recommendations on the utilization of Honduran pine, a subject which has also been studied more than once by North American industrial interests. Other entities in Central American countries have also studied proposals for pulp and paper projects.

The Industrial Development Institute (Instituto de Fomento Industrial, or IFI) of Colombia, has as one of its aims the study and development of new industrial projects, and has prepared a number of studies on the national paper industry, as well as some project case studies. Apparently, IFI farms out most of the detail work for a study, and then uses the results as the basis for a summary report. In addition to providing and reviewing such studies, the Institute has sometimes made a financial contribution. Projects such as Pulpapel's tropical wood pulp mill have been co-sponsored by IFI.

In Chile, the situation is much the same. The State Development Institute, CORFO, has taken an active part in the industry's development, mainly by providing for the study of economic and financial aspects that enter into inter alia pulp and paper enterprises. Sometimes the work is done by CORFO or its affiliates; sometimes (as for a recent report on Arauco) the work is contracted out overseas. Recently, CORFO has decided to take part financially in some of the new pulp and paper projects being proposed.

On several occasions in other countries the Central Bank or some other central agency has prepared, or contracted out, economic studies on pulp and paper. They have not always been published as some are of a confidential nature.

It would be interesting to verify whether these studies have contributed substantially to the region's ability to solve its own problems on industrial pulp and paper projects: this is probably true in some cases, but certainly not in the majority. Clearly there is insufficient knowledge in the region about the study of feasibility, engineering and plant economics in relation to pulp and paper production, and the studies that exist are not fully available to the industry in general or individual firms, or even, in some cases, to the Government. This, in addition to such technological research and know-how, is an area in which the region is generally deficient and depending on outside services.

#### 4. Company research and their related functions

4.1 Only a few companies are large enough to help themselves in matters relating to process and control technology, research and marketing. The high turnover and earning capacity of these few allows them to take the necessary technological measures and to balance their technical needs against the company's financial resources. The process is self-sustaining: the availability of more technical and marketing know-how leads, if properly used, to better profits and in turn to more know-how. It is unfortunate that smaller mills have neither the ability to sustain themselves technologically, nor the financial means to avert the technical obsolescence which is gradually undermining them.

It would be most interesting to know the physical or financial limits of a company, in relation to the process of sustaining themselves, as illustrated above. Unfortunately, the many factors on which this depends, are inter-twined and inter-related to such extent that knowing its limits is impossible.

In addition to such factors as gross earning capacity, tax measures, market expansion and product technology (including type of product and processes) the subjective ideas of what can nor cannot be financed enter into the decision, and much depends also on the risks a company is prepared to take, especially in the critical capacity range where such decisions affect the company's growth. The alternatives are to take greater business risks, or to find a way of making technical services and research-related functions available more cheaply, that is, at a lower unit or mill cost.

There are manifold examples of companies which, in the face of a technological or purely financial challenge, have accepted the chance to expand at a moment where the final outcome, or even the total cost, could not be assessed; but the opposite also occurs much more frequently than one might think. Such decisions have a profound effect on a small company's operations.

There is no doubt that the future development of the industry will be in the direction of more concentration of capacity, increasing efficiency and higher quality. In the course of this process, some mills will go under because of lack of funds, lack of market strength, or insufficient production know-how and technology.

While this is bound to happen in countries where the small production units are increasingly exposed to severe marketing and other stresses, it is interesting to note what certain companies, some of them originally quite small, have done in the past to develop into major enterprises.

/This applies

This applies particularly to bagasse pulping, where some pioneering companies have profited from successful methods of improving bagasse utilization, some of which they themselves have developed. Moreover, some small firms have succeeded in expanding by developing modest processes, tailored to their own needs, whereby materials can be produced that blend well with their conventional raw materials. Cases in point are the development of tropical-wood pulping in Colombia, and the pulping of local unconventional woods in Argentina and Brazil.

It is not so much a question of actual research carried out on the company's own premises, but rather the use of existing know-how and technology by such companies and their adaptation to production conditions in their own mill. The development of available technological knowledge into something productive is the main object, and contrasts with the much easier course (sometimes sound, sometimes short-sighted) of importing the complete technological complex, i.e. purchasing the machinery and the know-how together. The problem is the same not only for mill expansion or modernization, but also, though less obviously, for modified or new products. This means that, even where machines, processes or products have been purchased outright, their success nevertheless depends on the domestic capacity to provide the necessary technology-related functions, particularly when the purchase is of a complex nature.

While in many cases the importing of a complete new facility is a sound choice, or outright purchase of procedures for a new product is preferred, this course runs the danger of imposing an unfamiliar technology on a company which is not geared to absorb or service it. Hence it is clear that the most successful acquisitions are those which can be absorbed, by a company in terms of size and quality, without major difficulty. The implication is that equal weight must be given to technological and other, commercial and financial, considerations.

4.2 In the short review that follows of companies engaging in "extra-curricular" activities in research and related functions, no rule can be laid down as to which size a company must attain before it can undertake its own research. The importance of size varies. It can be said that with few exceptions a non-integrated company, of less than 10 - 15,000 TPY is unable to undertake its own research. A much bigger scale is necessary before single-product companies can undertake research. Another rule is that multi-grade paper mills, especially if integrated, and more specifically if they embark on complex processes, tend to start research-related work at a lower size level.

The most notable examples of industrial expansion in Latin America, from a technical standpoint, are bagasse pulping and paper making. Pulping of bagasse as a commercial operation has been developed exclusively by private interests, over more than a quarter of a century. The first notable success was the installation of the Grace mill in Puerto Rico. The many Grace pulp/paper mills have been patterned on this mill with some improvements, and much of the bagasse pulping elsewhere, is also based on it. Many mills operate along the same lines and with machinery based on that originally used in the Puerto Rico mill.

In Mexico, in particular, there has been much activity since 1945 in the development and adaptation of bagasse pulping techniques.

A striking example of modified pulping procedures with a widely acclaimed process efficiency is the San Cristóbal pulp and paper mill, which was developed into large-scale operation through the introduction of a succession of increasingly efficient pulping units, over a period of twenty years. The mill still contains equipment representing various stages of the development of the process, many of pilot plant size. The company's history is in fact, a demonstration of the development of a pulping principle from laboratory work, via several pilot plant stages, to large-scale operation. Subsequent use of bagasse fibre for such unconventional purposes as tissue grades, newsprint and printing grades has added to its achievement.

This development, which has only recently reached its successful conclusion, reflects the development of paper-making which took place in Europe at a much earlier period.

Other methods of bagasse pulping and of increasing pulping efficiency are being explored, notably by other Mexican mills, some of which have been very active in this field. Certain mills in Argentina and Brazil are also working on new bagasse-pulping techniques, although some of this activity (for instance in Venezuela) is of the nature of operational research. Mexico is outstanding in the search for new uses and techniques for bagasse pulp, and new approaches to pulping and paper-making.

Another noteworthy case in Latin America of an industrial process having recently emerged out of laboratory work is the production of short fibre pulp from mixed tropical hardwoods at the Klabin pulp mill in Southern Brazil and the Pulpapel mill in Colombia. Further laboratory work on the pulping process is under way. Research is also being done on bleaching. At the same time, the application of short fibre pulps to paper-making provides more specific know-how.

The utilization of plantation pines is a topic of major interest in Chile. Research on a modest scale is carried out to familiarize the companies with the pulp properties of pine wood, with the accent on the influence of fibre length and the variations that affect fibre length. Mixed cooks (with eucalyptus and other hardwood mixtures) have been carried out and the pulp properties of such cooks are known. Current research is directed to the pulping and growth properties of planted species other than pines. A certain amount of experience is accumulating on the effect on the end product of increased use of short fibre pulps in the manufacture of papers and boards, and the effect on machine running and sheet properties.

/In Brazil,

In Brazil, some of the companies that have developed eucalypt pulping, are exploring the effect of increased short fibre furnishes on machine running and on sheet properties. One of the principal objectives is to investigate the refining behaviour of short fibre pulps and their machine running properties.

Klabin has carried out an extensive research programme to determine the pulping and paper-making properties of hardwood species of southern Brazil, their characteristics in mixtures with long fibre pulps and in some cases their machine behaviour in pure and mixed furnishes. Pulp from mixed hardwood is being produced commercially. Attention has also been given to the growth of hardwood species that occur in the araucaria pine forest and their interference with regrowth. The pulping aspects of these forest questions have been examined in considerable detail.

Several of the larger companies in Latin America maintain research departments, do work about which little is known or work that has less significance than the spectacular examples cited above, but is nevertheless of importance. Much of this work is aimed at technical improvements, or at solving production problems; hence it is of less interest here, although the service is vital to the company. Such work, even though not examined here, should nevertheless be regarded as part of the technological facilities of those companies.

From the point of view of other companies, the noteworthy thing is that the influential companies consider it necessary to have easy access to modern technology and to allow it to influence the daily course of the mills, as well as the future development of the entity.



## 5. Organizational and other aspects of pulp and paper research

### 5.1 The quality of work so far

The region has abundant resources in fibrous materials suitable for paper making. Much of the industry's present expansion is based on the use of increasing quantities of short fibre pulps produced from bagasse and hardwood species. There has been a considerable increase in pulping capacity, in some cases accompanied by research work on pulping.

Mention has been made already of the Mexican work in the development of bagasse pulping. The development of bagasse-pulping techniques has been complemented by experiments on the use of short fibre pulps for a variety of papers. Bagasse-pulping research is now aimed at finding ways of using bagasse fractions, eliminated from the pulping process, as fillers for paper or for other purposes.

Reference has also been made above to the experimental work that led to basic patents on the sulphite pulping of mixed tropical hardwoods, a process developed for southern Mexican species, but for which no industrial application has yet been found. Other pulping work in Mexico relates to the utilization of vascular tissue of cacti.

A variety of other work is also being carried out in Mexico, such as quality control checks, instrument and testing apparatus comparisons, questions of water use, wet end problems of paper machines, and development of new products. Much analytical work on pulp and paper is done as a service to industry, and for the purpose of experimental pulping runs.

The general impression is that Mexico's institutes are eminently capable of advising on industrial problems of all sorts. They are well informed of the various problems and principal technical difficulties that the industry faces, and are well qualified to deal with them.

One feature of the Mexican research service is that their laboratory results can always be checked through pilot plant runs. This is the standard procedure. Pilot-plant runs are necessary to translate laboratory results into industrial terms. For this reason, much laboratory pulping work elsewhere, interesting as it is, does not lead to tangible results. By and large this is true of most other regional pulp and paper research. If in the course of an evaluation project for a certain raw material laboratory work on pulping and pulp properties cannot be interpreted in terms of industrial results (whether pulp yield, materials or power balance or sheet properties on a commercial paper machine), the laboratory work, though still interesting, does not produce industrially usable data. Such small-scale research only fits into a chain of otherwise necessary work, but it does not replace the other elements of that chain. In this respect, the value of general pulping research in the laboratory is extremely limited. The same applies to papermaking experiments with the table-top fourdriniers often used to show the runability of laboratory pulps.

/The above

The above comments should provide a clear indication as to the usefulness of much of the general run of pulping research throughout the region.

Laboratory pulping investigations of a useful kind, such as those found in Chile, are concerned with the variables of cooking and raw material. By determining the variables, such work leads to a better knowledge of industrial pulping procedures and helps to determine optimum operating conditions.

The IIT in Colombia has done a limited amount of useful work on the economic aspects of pulp and paper in the country, including a small amount of laboratory work.

The work in Mérida (Venezuela) has been confined mostly to laboratory pulping research apart from work on a few industrial requests on technical matters. There is a considerable amount of exploratory pulping research on Guayanan species: kraft and semi-chemical cooks have been studied. The laboratory pulping work is being checked against results in the Madison laboratory in the United States with the idea of determining the possibilities of producing bleached and unbleached papers from the mixed tropical forests of Guayana.

The new pulp and paper centre in Argentina, supervised by INTI, will confine itself to quality-control testing at the request of industry, and will also carry out some other work of interest to the industry. The laboratory will have only a small staff, for the time being.

Argentina is an example of a country which has a substantial paper industry, made up of many small mills which nevertheless have experience in the production of a great variety of papers. There is little pulp industry, and it is expected that the industry will continue to depend mainly on pulp imports. Certain short-fibre pulping facilities have been developed. The industry is an example of a conglomeration of small production units overshadowed by one dominating company, and without outside technical help it may be very difficult for these small firms to develop into technically and economically sound enterprises. There is undoubtedly a shortage of technological consultant services. Moreover, this situation is an illustration of the minor importance of developing pulping research, in relation to the need for advice on papermaking questions.

In Brazil, considerable research has been carried out in two or three public institutes on the pulping of mixed tropical hardwoods. The work is of the laboratory type, which may be one reason why nothing has yet resulted from it. The Klabin development (pulping of mixed semi-tropical hardwoods) was carried out exclusively within the firm itself, and led to the commercial pulping of mixed hardwood species that grow side by side with Araucaria, and can consequently be harvested at very little extra cost.

The cost aspect, of course, is the main reason why the pulping of tropical hardwoods has not yet led to the establishment of any mills. It poses certain well-known problems and where alternative raw materials are available (in places close to the markets) these have until now been preferred.

It is not known what other aspects of pulp and paper problems the Brazilian institutes are able to handle competently. It has been said that the accent in Brazilian research has been on the utilization of mixed hardwoods for pulping. Little technological counsel comes from it and the pulp and paper companies have, on turn, not frequently requested their services.

Except for Mexico, the work done so far has not had much bearing on the needs of the industry. The work done can, however, be considered as a first step towards organizing pulp and paper work. In that respect, the institutes have certainly familiarized themselves well with pulp and paper work in general.

The next phase is more difficult, because it must deal with industrial problems which are inherently rather complex. This means that the initial outlay is only warranted if the research is likely eventually to serve a certain useful purpose. A most obvious purpose is, of course, to solve industrial problems that the industry alone (the small and medium size mills) can neither solve, nor provide funds for the relevant research work.

Some firms do not even fully realize how far their technological problems create production or product difficulties. Other mills, which recognizing a need for technological advice, hesitate to take their problems to others who show no signs of being capable of solving them.

The basic weakness is that, in the first place, the institutes are not really geared to deal with a multitude of industrial problems, and that, secondly, their reporting is often so little to the point that industry does not recognize its application. The problem of pulp and paper research and the related functions of advice and technological service is that it is not carried out on a sufficiently large scale. The quality of work and reporting suffers on that account. This, in turn, is due to a lack of money and equipment (pilot-plant equipment being a necessary element), and this, again, is due to the expensive character of much applied research. The net effect is that actual work is confined to the easiest variety, and this even must be considered less than the absolute minimum to sustain the work by itself.

## 5.2 Methods and standards

A few words are in order on standardization for pulp and paper, and methods of research. A great variety of standards exists, and some of them are used throughout the region. The most common standards for testing and reporting are the Tappi standards. Others less frequently used include the German, British and Swedish national standards. The most important thing is not so much to use one specific standard only, but to use whatever standards are selected as precisely as possible and report the procedures accurately.

It is, of course, advisable to use Tappi standards for communication purposes. In the case of international requests, it will eliminate possible confusion.

The use of equipment of various origins is a rather more dubious practice. Laboratory equipment includes apparatus from North America, Germany, Great Britain, France and Scandinavia. Some of it belongs to specific standardized procedures, for example, a Valley beater. A run in a Wennberg hollander is not necessarily the same as in a Valley hollander. It is in equipment, that there is the greatest need for standardization.

## 5.3 Technical meetings and technical associations

Mexico has organized the first technical association in Latin America, and also publishes an important technical magazine on pulp and paper. The activities of a technical association greatly assist the diffusion of technical knowledge on pulp and paper. The Mexican association has many members among the pulp and paper industry. Once a year the Mexican association organizes a meeting that provides an opportunity to present research and other papers on pulp and paper questions. The meetings, five of which have been held thus far are growing in importance and have acquired a certain fame among Latin American technicians in this field.

The organization of national technical associations in other countries of the region is recommended, because they can support a multitude of national activities, as the Mexican organization does. National organizations are, in fact, preferable to the organization of a Latin American chapter of Tappi. Interesting as a regional Tappi group could be, its activities are likely to be hampered by the high cost of communications and of meetings. It is often said that the creation of national associations that are less expensive to run is overdue. However, the initiative must remain with the national companies and individuals.

At the international level, the best course is to allow the national meetings on pulp and paper technology to develop a form of prominence which will constitute a natural and continuing attraction to foreign visitors. This is already happening now in Mexico. It is also the natural course eventually to a regional association in which Tappi members may play a role.

#### 5.4 Quantitative and qualitative aspects of research

In general, Latin American research on pulp and paper is of recent origin, like most other specialized forms of research.

A study of the content of pulp and paper research in the various institutions reveals many common denominators. This is hardly surprising, considering that most of the pulp and paper work was initiated by the Government which, having allocated the funds, has naturally influenced the work done.

In the most favourable cases, work programmes have been determined in collaboration with the industry, which made possible work of industrial significance. Whether this was published or kept confidential does not matter in this context.

In the most unsatisfactory of cases, however, programmes were set up and carried out solely on the initiative of government officials or people who knew little of the industry's problems except that at the national level certain raw materials for pulping needed investigation. Sometimes no industry of importance existed within the sphere of influence of the institute. Yet research work on pulp and paper was carried out because it was expected that it would promote the national interest.

It is characteristic of much of this work that it has the simple aim of proving experimentally that certain fibrous raw materials can be pulped successfully on a laboratory scale and made into paper on a sheet mold. It was in this way that much of the work on marginal resources (banana stalks, lemon grass and other grasses, certain wood species growing in far-away places, palms, hardwood species pulped for kraft paper purposes, etc.) was begun and became a subject of discussion for many pulp and paper projects that never materialized. The value of laboratory pulping experiments is relative and depends on other (non-laboratory) evaluations.

The above comments should make clear how much of the region's pulp and paper work is really of limited value, since it merely demonstrates the relative possibility of pulping certain fibrous materials in the laboratory. The use of tabletop paper machines, contrary to the impression sometimes given adds nothing essential. It must be regarded as a tool for producing a continuous sheet of paper, the qualities of which, unfortunately, have no bearing on industrially produced paper nor on those of handsheets. Paper machines such as these serve certain useful purposes, for instance in the colouring of paper, but their applications are limited.

Nevertheless, laboratory pulping work does have a certain value, for instance by increasing national awareness of the value of domestic materials. This may lead to more thorough investigation of the possibilities, and eventually to the establishment of industry. The mere installation of pulp and paper research facilities in countries of the region is valuable. They are expensive to install and now that they are

/available, pulp

available, pulp and paper firms should find it easier to develop and obtain the services they need. The accent should be on encouraging firms to make use of research, and ensuring that the government research services are available at reasonable cost and are of a quality that can contribute to the performance of industry.

In evaluating the quality of research, it must be conceded that many pulp and paper sections are geared for small items of work only, and are not equipped to handle the variety of pulp and paper work that can be requested and which will be touched upon later. It so happens that these sections, busy as they are with pulping evaluations, have seldom been confronted with other work such as white eater reuse, stock composition for specialty papers, stock refining, smoothness of paper, headbox problems, coating colors and surfaces, materials balance, etc.

With so much of the pulp and paper industry well established and eager for expansion and improvement, the main interest will shift gradually to more sophisticated mill problems, some of the trouble shooting variety, others relating to the development of new products, improvements in mill efficiency, quality control, instrumentation, and so on. The shift in emphasis is clearly seen in the work of the Mexican institutes, where pulping research is still carried on, and was originally the principal concern, but where now other problems are worked out at the request of industry. A similar development is expected to take place in other countries of the region notably Brazil and Argentina, where the institutes are not yet so well equipped (in terms of instruments and experience) to handle these problems.

With the exception of Mexico, much of the work on pulp and paper is inadequate in relation to the problems that the industry encounters. Although the research work answers questions put by other interests, usually those of national focus, it does very little for industry itself. Moreover, the quality of work is frequently below what would be necessary to satisfy the industry. To raise the quality is a difficult proposition because it involves personnel problems, including salaries and is also related to the size of a research unit. As it happens, most pulp and paper research units (again excluding those of Mexico) are too small to solve other than the easiest questions, pulping and sheet evaluation tests being the most common. Lastly, the quantity of pulp and paper work is too small to support the process of self-sustaining growth which would otherwise lead to fully versatile pulp and paper research facilities. Many interrelated factors, and faults on both the research and industry sides, tend to prolong the lack of understanding, in relation to applied research, between those two sides. Pulp and paper research is still continuing along very much the same path, doing work of limited interest to industry, and reporting it so inadequately that industry remains uninterested. The industry, on the other hand, does not farm out its production or product problems because it has no reason to believe that research is able to give the answers.

/The questions

The questions that need considering are the need for experienced and well-paid staff, continuity of both staff and work, a sufficient scale of work performed, in terms of personnel and projects, efficient contacts with the industry and readiness on the part of industry to give outside research a certain place inside the mills. Where that would be too heavy a task on a national scale, it is preferable to limit the work programme of the research section to as much work as is asked for or agreed to by the industry, and which can be carried out within the funds allocated. The Argentine pulp and paper laboratory, CICELPA, carries out a limited amount of quality control work, and is thus preparing itself for further industrial contacts; this example is worthy of note.

The course of action proposed, naturally includes the present pulp and paper sections that were incorporated in the major research institutes of Latin America in the course of time. Their existence is considered as an appropriate basis for the development of technological work which, in line with the changing operating conditions of the industry, must grow into a service that can cope adequately not only with general national pulp and paper problems, but with all specific questions raised by the industry itself. A reasonable cost for work requested is part of the terms of understanding that are necessary between the industry and national institutes.

#### 5.5 The concept of cost

The research institutes that do pulp and paper work all agree on the principle that the cost of research should be calculated and charged to those who request it. The differences that exist relate to the amounts chargeable for overheads and use of facilities. And, of course, one source of differences in gross cost of work performed is the general salary level.

A comparison of costs is of little value because it cannot take into account the differences in quality of work; in this, research resembles consultant services. A reputation for quality is a necessity for both.

A comparison for data on research costs in Latin America and overseas reveals little, except that gross cost is usually calculated in the same way, and that the proportion of the total cost represented by the various components (staff, use of equipment, materials, overheads) is much the same in both cases.

It is found that little is allocated from the official budget to reduce the actual total cost of work done on request. This is invariably the case except where the institute participates financially (as IMIT does) in a research project. In other words, official contributions apparently serve the purpose of enabling the institute to continue doing research work, while individual requests (except those from the offices that allocate the money) pay for the gross cost of a project; in fact this is a reasonable way of financing any work.

/In terms

In terms of averages of fluctuating figures, the total salaries of research personnel were found to be approximately 40 per cent of gross cost, with overheads and administration, etc., costing another 40 per cent. The remainder is for the cost of using equipment (not including purchases of equipment), depreciation, and various materials. This breakdown is much the same for Latin America as for other parts of the world. This applies, of course, only to those research subjects that do not require very high investment or extraordinary skills, but relate to less costly research in the textile, printing, pulp and paper, leather, food, and similar industries.

Few data are available on the cost of research work at institutes overseas, and they refer to the above-listed group of industries rather than to pulp and paper only.

The gross cost per chemist or engineer, for research in institutes and industry, is given as 20,000-24,000 dollars per year (United States, 1959) and 19,000-21,000 dollars (Great Britain, 1961). The corresponding data for pulp and paper research are said to be an average of 20,600 and 19,000 dollars, respectively. The Netherlands TNO research institutes often calculate the cost of research as some 17 to 20,000 dollars per man-year, about the same as the figures quoted above. Unfortunately, no other reliable data are available. In view of the salary levels obtained, the data quoted confirm that about 40 (35 to 50) per cent of the cost usually represents salaries, the same proportion as indicated by the Latin American data.

Even less data are available indicating gross national expenditure, on pulp and paper research in Latin America and overseas.

There is no doubt that the United States, Canada, Japan and certain European countries, which have major pulp and paper industries, also spent the highest proportion of sales returns on research for these. The estimates vary widely, but a few data are presented in table 8.

In the United States research expenditure has multiplied rapidly during the last twenty years. Data quoted are 0.2 to 0.3 per cent of total sales for post-war years, and slightly over 1 per cent during the sixties, for total expenditure on public and private research on pulp and paper.

No data on expenditure could be collected for Latin America. As a rough estimate, a figure of 0.10 to 0.15 per cent, for pulp and paper research at institutes and in private companies, is given, subject to reservations. This figure would indicate that some 800,000 dollars will be spent during the current year on pulp and paper research. This figure includes public research, calculated as 500,000 dollars this year, and company research. It is estimated that of the 500,000 dollars for public research, 280,000 dollars are spent in Mexico alone. Mexico is probably responsible for a similar proportion of company research. Total expenditure for research in the industry would be of the order of 300,000 dollars most of it, of course, carried out by the major companies.



Table 8

EXPENDITURE ON PULP AND PAPER RESEARCH IN SELECTED COUNTRIES

Country	As percentage of sales (1959) a/	As percentage of net output (1958) b/
Canada	0.4	-
United States	0.8	0.9
Japan	0.5	-
United Kingdom	-	0.8
Sweden	-	0.8

a/ This covers all companies reporting research activities.

b/ Total net output of the paper industry (for Sweden and the United States the percentage is based on the value added).

/The estimates

The estimates show two things. The first is that, apart from Mexico, research expenditure on pulp and paper technology is very low in Latin America; this confirms the impression given by examining the record of research institutes. The second is that while research services in Mexico are considered adequate, expenditure in the other countries, notably Brazil and Argentina (where the bulk of pulp and paper capacity is found) needs to be raised considerably. If Mexico's expenditure is estimated as 0.25 per cent <sup>2/</sup> of total sales, then amounts of 550,000 and 400,000 dollars a year should be necessary for research in Brazil and Argentina respectively.

A further analysis shows that the critical point where the supply of research services is sufficient can only be reached through higher spending by industry, and higher budget allocations by the Government. The latter is particularly important for the creation of pulp and paper facilities of sufficient size and quality (to permit, inter alia, installation of proper equipment, including pilot plant equipment), so that the industry will in turn, depend more on these services. Some ways of ensuring co-operation between industry and the research institutes will be discussed below.

#### 5.6 Possible forms and subjects of industrial research in pulp and paper

As already indicated, much pulp and paper research work is done in a general fashion, without regard for industrial problems, and arousing only casual interest in the industry and the reason given was that so much of research financing depends on public finance, and so little is contributed by the industry.

On the other hand, much of the region's industry is accustomed to work without the benefit of technological services, research, etc., and tends to underestimate their value. The companies that have a record of taking advantage of technical innovations, are those that understand technological language. Most small and medium size mills, however, have not reached this level and hesitate to admit that research and research-related functions are of more than casual importance. As more new paper and board products appear, quality requirements rise, and unconventional uses of raw materials become technically possible, the dependence on technological consultation increases. The mills that grasp this fact have the best chance of meeting this challenge and taking advantage of it.

For industrial research, the pulp and paper sections in public institutes, and the research units within the larger companies, provide a convenient starting point. Certain conditions must be fulfilled:

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<sup>2/</sup> Considered satisfactory in relation to the lower level of consumption and the less dynamic market compared with Europe, and North America.

enlargement of sections, additional equipment, allowance for staff to familiarize themselves with major industrial problems in pulp and paper, a willingness on the part of industry to bring their problems forward and to apply the solutions and to finance the relevant research work. In the process, some fringe benefits may even be reaped: in the past sponsored research has produced profitable processes such as high yield pulping.

Affluence in research and technology cannot be attained unless more research service is available. A higher density of research capacity is needed to deal with the amount and variety of work, and to ensure the necessary quality. A jointly financed programme is needed to accomplish this, in the form of government funds for capital outlays, including equipment, and contributions from industry as payments for research and consultant work, of which a steady flow must be assured in order to allow the necessary staff to be employed on a continuing basis.

The following is a list of the possibilities for the organization and financing of research and research-related services for the pulp and paper industry. Some forms of organization are considered especially valuable for ensuring continuous industrial interest. It should be emphasized that the alternatives are given with special attention to the present situation of the small and medium sized mills, <sup>3/</sup> which cannot maintain their own technological services. The assumption is that all the following would be organized as sections of the existing research institutes of Latin America:

- (a) Research fully financed by public funds - work programme determined by the desire for utilization of national resources - no industrial influence.
- (b) Research fully financed by public funds - work programme emphasizes national raw materials, but industrial requests are considered.
- (c) Research financed by both public and industrial funds - work programme determined by national and industrial interests - individual requests of companies are carried out.
- (d) Research financed by industrial funds are carried out according to the wishes of the industry - individual requests carried out.
- (e) Research in a co-operative form, paid for by interested companies and carried out within an institute that is otherwise maintained by public

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<sup>3/</sup> A survey of the problems of small pulp and paper enterprises in Argentina and Brazil has been carried out. The report, to be presented at the ECLA Regional Symposium on Industrialization in March 1966, analyses the influence of organizational, commercial and technological factors on the performance of small mills.

funds; a co-operative association is formed either by industrial firms or by public and industrial interests together.

The purpose of the list is merely to indicate how many similar possibilities exist that would permit work to be carried out as an expression of national or individual interest. One or two specific proposals must be examined in more detail.

Co-operative industrial research is the most effective means of pooling personnel and financial resources, with prospects of success. The industrial approach ensures that the solutions found will eventually be industrially applicable and the co-operative form ensures that a sufficiently large and experienced team is put together to carry out the work. Financial contributions from companies ensure that research results are rapidly made available for industrial application, and also help prepare the mills for modern methods at low individual expenditure.

The other form of organizing the work is to have a section which, in addition to doing research work, is capable of industrial counselling on technological and control matters. Quality and process control are both important aspects of this work. Possibly the bibliographical services, reviews of equipment, etc., should also be included. There are no pulp and paper literature reviews in Spanish or Portuguese presently.

There are abundant examples of the effectiveness of these two forms of organization of pulp and paper research. Co-operative research is practiced on a large scale in the United States, but one example will suffice, the ESPPRI (Empire State Pulp and Paper Research Institute) which carries out co-operative research on a confidential basis, the results being made available to companies that are members of the association that sponsors the Institute. One of the principal areas of interest is high-yield pulping and brightness of high-yield pulps. The Institute applies for patents where appropriate, and these are available to members.

An example of the second form is the British Pulp, Paper and Board Makers Association, which maintains a specialized laboratory whose services are available to members. Much of the work is carried out as a service to individual mills, for instance the checking of testing apparatus, instrumentation, quality control, paper machine measurements, and so on. Other work is done under co-operative contract to groups within the industry.

The Swedish industry maintains a pulp and paper laboratory, supported by industry-wide contributions and by individual commissions on confidential projects. This is yet another example of co-operation within the industry.

The principal laboratories in Mexico have achieved a similar type of service, and though smaller in size, carry out similar work. Thus far most of their work is done on the request of individual companies.

/The other

The other areas of Latin America, however, have no specific research or technological services. Yet in many cases industrial practice needs this type of direct service, and the industry finds the general type of pulp and paper research work so often carried out much less helpful. In much of the industry there is an unmet need in the field of recent technical advances; instrumentation, the development of new products, the economics and technique of new processes and so on. To this list might be added certain subjects such as calibration of testing instruments, quality control in mills, measurements on power and material balances, and on the performance of paper machines; all subjects that are under study in the major laboratories of the world.

Then, last but not least, there are a number of specific subjects of particular importance to the region on which at present little work is being done. It is believed that in the appropriate cases such work would repay the outlay required:

- (a) Disc groundwood from eucalyptus.
- (b) Disc groundwood from tropical wood species capable of being grown in plantations of single species, in short rotation.
- (c) Advance techniques of bagasse pulping (well covered in Mexico only).
- (d) Industrial aspects of the pulping and bleaching of mixed tropical hardwoods.
- (e) Paper manufacture from stock compositions with increased amounts of short fibred pulps.
- (f) Refining technique for short fibre pulps.
- (g) Coating of inexpensive publication grades.
- (h) Printing performance of conventional printing grades.
- (i) Performance of packaging grades, with reference to the manufacture of paper from short fibre pulp and pulp mixtures with short fibre pulp.

5.7 International assistance in applied research on pulp and paper

Most research institutes maintain good contacts with the prominent institutions overseas, especially those of the United States. Armour Research Foundation has had a profound influence on the course of research on more than one occasion, and the names of other institutions could be mentioned.

In many cases the assistance and co-operation relate to such subjects as food chemistry, food processing and chemical analyses, fields in which certain research institutes have gained some fame. Little or nothing has been done for pulp and paper. The exceptions are, of course, cases where parent companies (from the United States and Canada, as well as Great Britain) aid their subsidiaries, and where agreements of technical assistance are made between companies in the region and overseas. During the period when pulp and paper laboratories were established in Mexico, assistance was given by United Nations and its specialized agencies. Very little has been done since. Pulp and paper, it may be concluded, is a neglected field.

Cases have been reported where local industry and the local research institutes have tried to obtain international assistance for pulp and paper work, without result. The following list is intended to illustrate ways of applying for overseas assistance:

- (a) The United Nations Special Fund and its Expanded Programme of Technical Assistance;
- (b) Bilateral assistance from European and North American Governments through the research institutions in those countries;
- (c) The Inter-American Development Bank and other international banking institutions, through applications for soft loans, and in certain cases for hard loans.

Other possibilities, such as the organizing of a research facility with the aid of overseas companies or research groups are in a different category and, although deserving mention, do not call for further examination.

Bilateral assistance has two favourable aspects, namely, that assistance can be procured (by proper selection of the country) through a specialized institution of repute, and that technical assistance, can be financed through the same channel. Even gifts of equipment are sometimes part of the over-all aid programme.

Soft loans from international financing institutions are another important source of assistance to be considered. Granting of the loan will usually indicate that the project is considered viable and personnel assistance can be procured by other means, the financing of a project

being a first important step. It is believed that co-operative pulp and paper research (sponsored by a group of private companies with common interest in the subject of work) can fulfil the conditions for the granting of these soft loans, and perhaps even of hard loans, if the subject of research is likely to produce profitable results in a short time.

#### 5.8 Regional co-operation in pulp and paper research

The funds for research on pulp and paper technology are extremely limited, and in fact must be considered as less than sufficient to service the industry adequately. Moreover, existing capacity for research in this field is limited, and experienced technicians are hard to find. In these conditions, some degree of co-operation between the major institutes is highly desirable, and could also ensure that the most efficient use is made of the existing resources.

There is no doubt that with the proper organization industrial requests will gradually increase and eventually exceed the research capacity of research facilities until such time as more is spent on research expansion to meet the increase in industrial requests. In the meantime regional co-ordination can ensure that efficient use is being made of existing research facilities, and can help to keep the research services of industrial institutes on a high level of quality. The expansion of pulp and paper facilities will probably be accompanied by specialization on subjects of more than routine interest to the companies within the sphere of influence of the institutes. It is expected that research facilities, in their transition from pulping laboratories to more complex entities, will develop, in addition to a basic capacity to deal with routine problems (such as instrument testing, quality control and analyses), a degree of specialized knowledge on certain matters that form part of pulp and paper technology. A case in point is the bagasse research carried out in Mexico's institutes.

In all these respects, a pooling of experience between institutes is desirable, and a knowledge of each other's work and capacities will facilitate this pooling, and eventually make the fruits of research available to a wider audience. Such an arrangement would be particularly appropriate in view of the scarcity of research results on pulp and paper in Latin America, due to a shortage of funds for that purpose, and the somewhat low technological level, often found in the smaller mills. Regional co-operation quite apart from its own intrinsic usefulness, will ultimately contribute to the technological updating of many mills, since it will ensure that the industry becomes increasingly aware of the possibilities of technological innovations.

The point made here is that the regional co-ordination of pulp and paper research should be oriented with the interests of the industry in mind, in other words, there should be special emphasis on a full exchange of information about industrial requirements, and care should be taken that the industrial aspects have an appropriately important place in the pooling of experience that would accompany regional co-ordination.

/It is

It is highly desirable to ensure that some degree of co-ordination of research work on pulp and paper problems is effected. Individual efforts gain in strength and standing if sustained and complemented by other related work. As already stated, the pulp and paper industries of different countries have varying characteristics, and their problems can be dealt with at the national level in such a way as to give a complete view of pulp and paper technology.

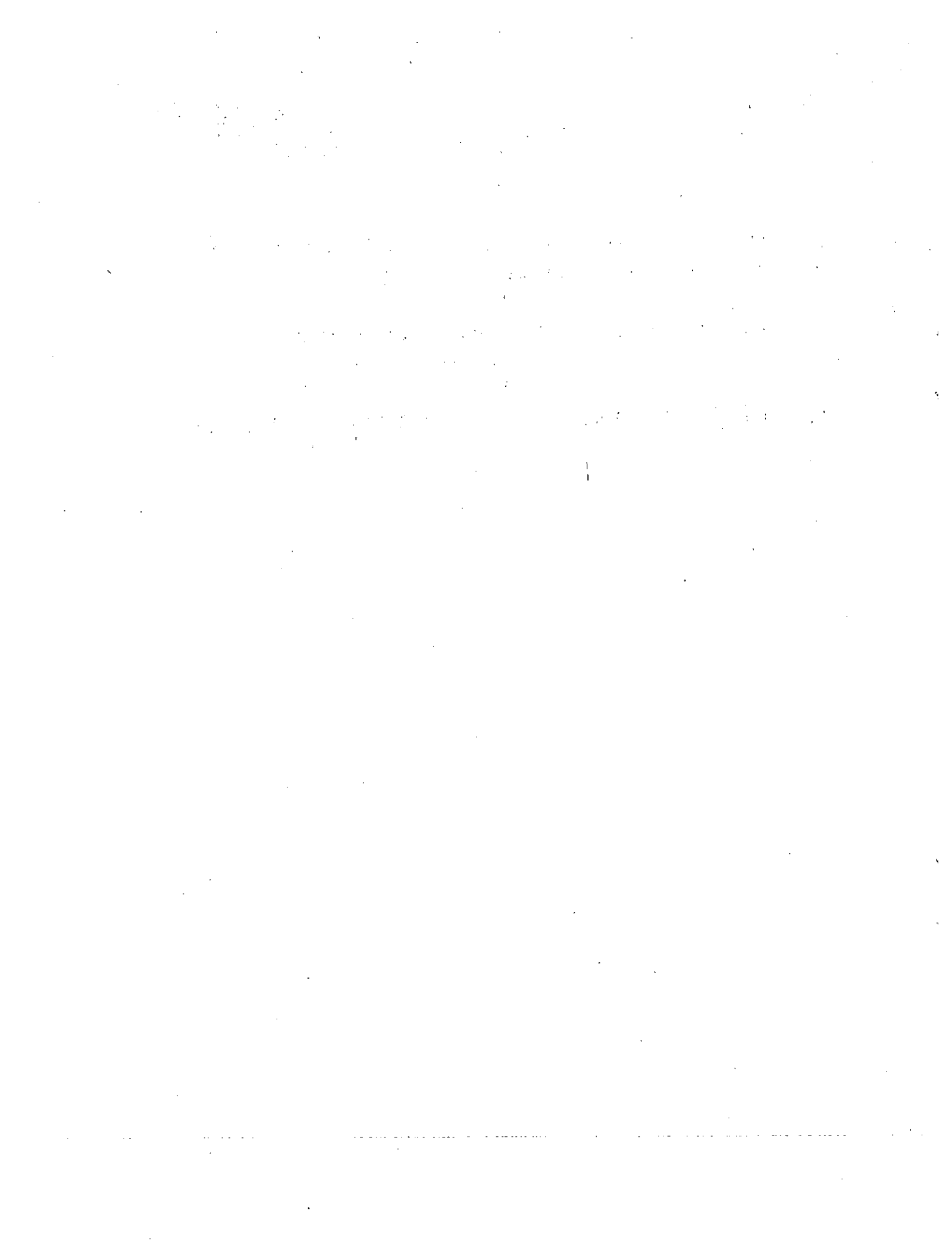
As in other sectors of applied and industrial research, meetings at regular intervals appear to be the most effective instrument to achieve regional co-operation, on the basis of voluntary and necessary exchanges between the institutes themselves, in matters of research work, work programmes and the use and dissemination of pertinent facts known to individual institutes. The advantages of uniform methods, procedures and ways of reporting are perfectly obvious. Effective co-operation makes a much larger research capacity directly available to the industry, and the aim of this chapter has been to show that industry needs and wants this additional service; in fact the above observations are in line with many questions from the institutes themselves on the possibility of periodical meetings where the progress and results of research, and co-operation in matters of mutual interest, can be reviewed. The most practical form that suggests itself is a regional meeting of the institutes themselves at which, in addition to sessions at the executive level for the purpose of taking decisions and effecting the desired degree of co-operation, working groups meet to promote the pooling of experience and to acquaint others with research results and the day-to-day problems of the work itself.

It is not implied here that it is only in the field of pulp and paper that such regional meetings will be effective; on the contrary, the best use cannot be made of the principle of regional co-ordination unless several working groups are allowed to discuss their work among themselves and share the experiences of others. The purpose of the present report is to arouse interest in industrial research in pulp and paper, for which there is a clear need. The expansion of other sectors of research must be the subject of other studies.



Annexes 1-3

1. List of government laboratories in Latin America engaged in research on pulp, paper and board (1965)
2. List of Trade and Technical Associations of the pulp and paper industries in Latin America (1965)
3. List of pulp and paper periodicals in Spanish and Portuguese



Annex 1

List of government laboratories in Latin America engaged  
in research on pulp, paper and board (1965)

The following list gives only the government laboratories in Latin America that are active in the field of pulp and paper and whose services are available to interested parties. The list excludes pulp and paper laboratories that are the property of industrial companies, and therefore not accessible to parties outside the companies themselves.

The pulp and paper research laboratories are sections of larger institutes that deal with various types of scientific and technological research. In a few laboratories, pilot plant equipment for studies on pulp and paper is available, in addition to the usual laboratory evaluation apparatus.

The cost of a research project to be carried out in one of these laboratories is usually determined on the basis of an actual calculation of the cost of the time required for the experiment, plus the cost of materials and use of equipment, plus overheads.

Laboratories will provide an estimate of project cost upon request. The services of the laboratories listed here are available to those who have an interest in them, e.g., government bureaux and institutes, individual companies, etc. The services are available within the country, and usually also to others outside their own countries.

In the case of international requests, the total project cost can differ from the cost of similar national projects, since the institute may receive a subsidy in exchange for which it has undertaken to carry out certain work of national origin. All these institutes have expressed interest in obtaining projects from Latin American countries outside their own.

/Research laboratories

Research laboratories in Argentina

1. Instituto Nacional de Tecnología Industrial (INTI)  
Centro de Investigación en Celulosa y Papel  
Libertad 1235, Buenos Aires
2. Dirección de Investigaciones Forestales  
Azcuena 1344, Buenos Aires
3. Laboratorio Tecnológico, Facultad de Ingeniería Química  
Universidad del Litoral  
Santiago del Estero 2829, Santa Fe  
Provincia de Santa Fe

Brazil

1. Instituto de Pesquisas Tecnológicas, Universidad de São Paulo  
Cidade Universitária  
Caixa Postal 7141, São Paulo
2. Instituto Nacional de Tecnologia  
Avenida Venezuela 81  
Rio de Janeiro
3. Instituto de Tecnologia da Bahia  
Rua Rio S. Francisco 1, Monte Serrate  
Salvador, Bahia
4. Departamento florestal de la Escuela de Agricultura  
"Sem. Luis Queiroz"  
Piracicaba, São Paulo
5. Instituto de Pesquisas Amazónicas  
Belem, Pará

Chile

1. Instituto de Investigaciones Tecnológicas  
Facultad de Ingeniería de la Universidad de Concepción  
Casilla 53-C Concepción

/Guatemala

Guatemala

1. Instituto Centroamericano de Investigación y Tecnología Industrial (ICAITI), 4a Calle y Avenida La Reforma, zona 10  
Apartado postal 1552  
Guatemala City, C.A.

Mexico

1. Instituto Mexicano de Investigaciones Tecnológicas A.C. (IMIT)  
Calzada Legaria 694, México 17, D.F.
2. Laboratorio Nacional de Fomento Industrial  
Avenida Industria Militar 261  
Lomas de Tecamachalco, México, D.F.
3. Instituto Tecnológico y de Estudios Superiores de Monterrey  
Carretera México a Laredo  
Sucursal de correos J. Monterrey

Venezuela

1. Laboratorio Nacional de Productos Forestales  
Universidad de los Andes  
Apartado postal 220, Mérida

Annex 2

Trade and Technical Associations of the pulp and  
paper industries in Latin America (1965)

Argentina

1. Asociación de Fabricantes de Papel  
Avda. Belgrano 2852, Buenos Aires  
The association is the private body representing the pulp, paper and board manufactures, and has a juridical personality.
2. Asociación de Técnicos de la Industria Papelera y Celulósica Argentina  
Belgrano 2852, Buenos Aires

Brazil

1. Asociación Nacional de Fabricantes de Papel  
Rua Assembléia 93, 8º andar, oficina 804, tel. 227415  
Rio de Janeiro  
Rua Dom José de Barros 17, 1º andar  
São Paulo  
The association is the private body representing the pulp and paper manufacturers.
2. Sindicato de Industria de Papel y Celulosa  
Rua Assembléia 93, 8º andar, oficina 804, tel. 227415  
Rio de Janeiro  
Rua Dom José de Barros 17, 1º andar  
São Paulo  
This trade association is the recognized legal representative of the pulp and paper industry. It has the same membership as the National Association.

Mexico

1. Cámara Nacional de las Industrias del Papel  
Manuel Ma. Contreras 133-305, México 4, D.F.  
The group represents the pulp, paper and board manufacturers.

/2. Asociación

2. Asociación Mexicana de Técnicos de las Industrias de la Celulosa y del Papel A.C.

Manuel Ma. Contreras 133-305, México 4, D.F.

Uruguay

1. Asociación de Fabricantes de Papel

Calle Treinta y Tres No. 1325, Montevideo

The association is the private organization of pulp and paper manufacturers and belongs to the Unión Industrial Uruguaya.

Venezuela

1. Asociación Venezolana de Productores de Pulpa, Papel y Cartón

Plaza Venezuela, Edificio Polar, 6<sup>o</sup> piso, Caracas

Annex 3

Pulp and paper periodicals in Spanish and Portuguese

(1) ATCP

Organo de la Asociación Mexicana de técnicos de las industrias de la celulosa y del papel A.C.

Manuel Ma. Contreras 133-305, México 4, D.F.

(Mexican, six issues per year)

(2) O papel

Revista Técnico-económica para la industria de celulosa y papel, conversión y de imprenta

Caixa postal 1430, São Paulo

(Brazilian, twelve issues per year)

(3) ATIPCA

Organo de la Asociación de técnicos de la industria papelera y celulósica argentina

Belgrano 2852, Buenos Aires

(Argentinian, six issues per year)

(4) Boletín

Del Instituto Forestal latinoamericano de investigación y capacitación

Apartado 36, Mérida, Venezuela

(Venezuelan, published irregularly)