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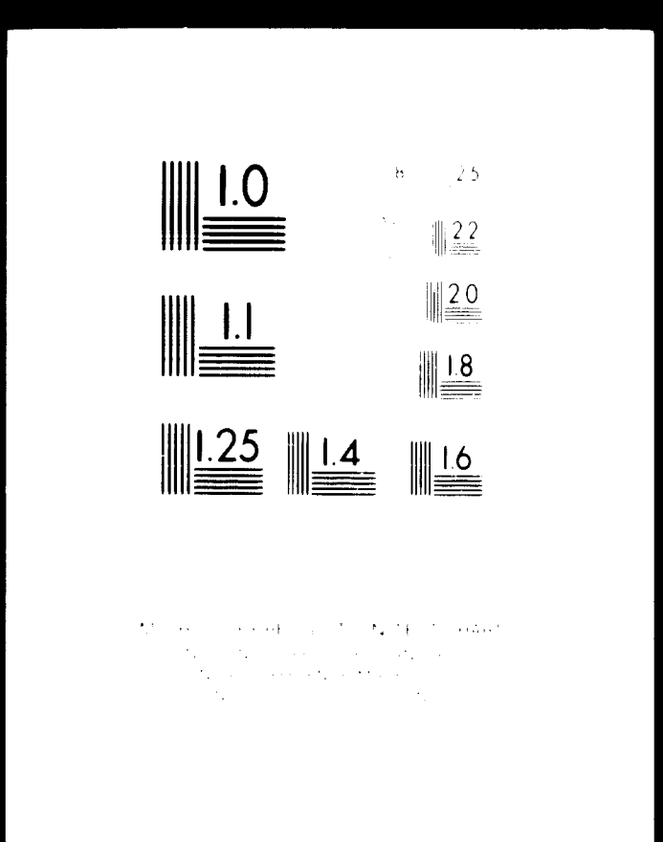

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Battelle Frankfurt

Report

03427

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Assistance to the
Institute of Technological Research
São Paulo (Brazil)

Report for

United Nations Industrial Development Organization

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Volume of Documents*)

*) Submitted to UNIDO in the original: not included in the copies of the report

Summary

1. The "Instituto de Pesquisas Tecnológicas" (IPT) is the most important institute of its kind in Brazil. It has an excellent reputation with industry and government.

   Its main activities - testing and quality control - helped much to develop industry by promoting quality standards decisively.

   By providing training courses for students and industrial staff IPT is of importance as a producer of technical and scientific skills.

   IPT has the potential to develop into a main research center of Brazil - comparable with institutes in fully developed countries -, provided that the necessary support by the State and/or other parties is secured.

2. IPT is an autonomous institution of the State of São Paulo with the status of "autarchia" and associated with the State University of São Paulo. It is rather independent in its business policy. The foremost negative elements of State influence are the formal and bureaucratic budgetary rules. They are not adequate to an institution that should be controlled more under cost-benefit than under fiscal aspects.

   A still more independent status, e.g. as a foundation, but with a secure financial basis and sufficiently close relations to the Government should be considered in the future.

3. The proportion of the revenue of its own- as opposed to the subsidies by the State of São Paulo - (in the past 6 years about one third of all revenue) is ex-

pected to increase considerably in the coming years, mostly on account of general contracts ("convênios"), concluded with the industry.

This sound trend should be promoted continuously, but curtailing of State subsidies to the same extent would have a very adverse effect on IPT's necessary growth potential.

4. The staff of IPT has increased from 537 in 1967 to 942 members in 1971. In the same time the percentage of professionals has increased from 17 to 23 percent.

5. The physical facilities of IPT include premises of about 240,000 m^2 and 30 buildings. The new buildings and those under contruction correspond to the international standard. The major part of the equipment is rather obsolete for research purposes.

6. IPT's central administration is responsible for routine work, such as accounting and invoicing, as well as for personnel administration and some auxiliary services. However, there are not enough highly qualified professionals to support the superintendent. Present main functions of the central staff mainly comprise legal services, industrial relations and cultural relations.

Important functions, e.g. modern budgeting and cost control, industrial liaison functions, certain project development functions, project evaluation and control, systematic utilization of research results, coordination of the technical divisions, are missing or executed insufficiently.

7. Thus, decentralization, according to which the divisions are free to develop their own policy and fully responsible for the execution of projects - for a scientific institute an efficient organizational form- lacks the necessary support by central staff.

As an institute of a purely technical nature IPT is subject to certain handicaps, because technicians and technical scientists are often unable to consider the economical aspects involved in nearly every technical problem. This reduces the scope of many research activities to the laboratory and experimental aspects of a problem. In addition the studies carried out may tend to miss the sponsor's real problems and may thus not achieve their objective in the best possible way.

Strengthening the interdisciplinary approach of IPT should therefore be an important aim of the business policy.

8. Important means to support such a policy would be improving project evaluation and utilization of research results with the help of staff members with a techno-economic background and entrusted with these functions and advising and training technical staff members in these fields.

9. Concerning modern management methods it seems most advisable to introduce cost accounting and fixed rules for precalculation of projects, to promote cost consciousness and to provide a basis for pricing as well as to promote the efficient execution of research projects.

10. IPT has elaborated a program for the establishment of an information center with a staff of nearly 150 members and a computer of considerable capacity. Realisa-

tion of this plan would help to fulfill important functions within the growing Brazilian industry; it would also promote interdisciplinary approach within IPT and cooperation between the divisions. It is, therefore, recommended to UNIDO to support this program as far as possible.

11. Long-term plans were lacking. The research projects of the individual divisions are widely scattered. A concentration of the fields of research will be necessary, especially with regard to the limited labor capacity.

12. It is advisable to send an expert to each division for studying the organization of the division and delimiting the competences more clearly. In addition, it is necessary to elaborate medium and long term research programs for each division, which have to be adjusted to the labor capacity and the funds available. The labor policy of IPT has to be adapted to these medium and long term research programs.

13. It does not appear opportune at the present time to extend the range of disciplines. The existing divisions should rather be expanded. In 1975 or later, it may be useful to establish a textile engineering division.

14. In the Civil Engineering Division the problem of space has to be solved first before the work can be rationalized. At present the division is accommodated provisionally in overcrowded rooms, and it is astonishing that so much testing can be done under these conditions.

The Mechanical Engineering Division requires first of all a special staff, to be formed from the staff of the division, which sees to it that the research programs completed and under way are made accessible to the industry and which is also responsible for selling them.

The organizational structure of the Wood Division has to be changed. This division suffers from the handicap of having no economic experts.

The Chemistry Division was rather reluctant to provide information. The questions posed were answered incompletely or not at all. Data concerning plans for the future development of this field of research were not obtained.

In the Ore Treatment Division it is necessary first of all to improve the labor capacity and the technical equipment.

In the Metallurgy Division it might be more favorable if the wide range of investigations would be restricted to two or three main projects.

The capacity of the Geology Division is fully utilized and its work is very efficient.

15. In each of the divisions the equipment may in part be regarded as obsolete. Owing to the rapid progress in all fields of technology, it has become a rule that adequate research is only possible if a laboratory is re-equipped every six to eight years.

16. "External liaisons" comprises the development and maintenance of contacts and relations with the industry, the state and federal authorities and the scientific institutions.

    Relationship with the Federal and State authorities is maintained directly by the Superintendence. The relations to the other groups are taken care of by the organizational units "Industrial Relations" and "Cultural Relations" set up for that specific purpose.

17. At present the relations and connections with private industry, public industrial establishments and foreign joint ventures may be rated as 'fair to excellent' concerning routine testing, 'inadequate to poor' concerning genuine research work, 'poor' concerning genuine large-scale contract research.

    The relations with government agencies and corporations may be rated as 'fair to excellent'. The connections with professional associations are to be rated as 'outstanding'. There exist close relations to the Polytechnical School of the São Paulo University. The relations to other institutes similar to IPT, however, differ in intensity and are in no way organized or institutionalized.

18. The general conclusion to be drawn is, that external liaisons at present lack the necessary capacity as well as the planned strategical approach.

    It is therefore to be recommended to expand the capacity, redistribute the special "External relations"-functions, integrate these functions organizationally,

establish the coordination of the "External Relations"-activities of the research divisions, define the responsibilities and ensure mutual information, establish reporting regulations, provide improved papers for information, identify potential clients systematically, develop a coordinated marketing activity, provide an annual financial budget.

1. Introduction

On November 17, 1971 the UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION ("UNIDO"), Vienna, requested Battelle Institut e.V., Frankfurt/Main, to carry out a preliminary investigation to review the situation and activities of the "Instituto de Pesquisas Technológicas" of São Paulo in Brazil ("IPT"). The investigation should enable Battelle to recommend measures appropriate to assist IPT in its endeavours to improve its methods and operating processes so as to meet the increasing demands of the country's economy.

IPT is a well-known and well-established organisation and the largest institute in the country carrying out material testing and research in many sectors of the industry, such as civil engineering, mechanical engineering, chemistry and chemical engineering, metallurgy, mining and applied geology, ore processing, and forestry and woods. IPT has developed and checked standards and specifications and has done much to improve the quality standard in the Brazilian industry.

The investigations covered

- a survey of the present importance of IPT as a part of the country's economy
- a survey of its internal organisational structure
- a survey of its research activities and an evaluation of its current and future programs
- a survey of the existing external relations and
- recommendations, on the basis of the analysis, on appropriate measures to be taken by IPT and UNIDO

to improve IPT's administration, to strengthen its research and development activities and to strengthen the existing ties with the public and private industry.

To gather information for the study three experts stayed in São Paulo for four weeks. During this time the Superintendent and IPT's management and the staff members did everything to facilitate our work; counterpart personnel and transportation facilities were made available for efficient and smooth performance of the study.

Some special documents collected during the investigation are too detailed and voluminous to be annexed to all copies of the report. As they may be of interest to UNIDO or to UNIDO experts being concerned with IPT later on, they are compiled in a special volume and submitted to UNIDO in the original. In the following they are referred to as "Volume of Documents".

2. The Present Importance of IPT as Part of the Country's Economy

Concerning the present research capacity (in terms of quality and quantity) Brazil has yet to be regarded as a developing country, although doubtlessly in the "take-off" stage.

In Brazil there are so far only a limited number of research institutes with research capabilities worth mentioning. IPT is at least one of the most important of these institutes. IPT has a tradition of about 70 years, and is with about 900 employees the biggest technical institute in this field. It is located in the most important industrial center of Latin America.

Capability and location are two of the most important requirements to carry out large-scale and complex research work.

The capabilities were used so far mainly for routine testing. In addition to the routine work IPT played an important role in the development of the São Paulo cement industry as well as the production of foundry materials.

Especially foreign companies erecting subsidiaries in Brazil use IPT for the transfer modification and adaptation of their products and standards for the Brazilian market and the special conditions of this country. Interviews carried out with several brazilian and foreign industrial and governmental (state and federal) representatives confirmed the excellent reputation of IPT.

At present transfer and adaptation of technology seems to be not very impressive. However, IPT should be able to strengthen its efforts in this regard.

In addition long-term planning of the different sections of research work is necessary. IPT should set priorities in coordination with government and industry.

As a producer of technical and scientific skills, IPT is of substantial importance already at present. For several years IPT has been training students and industrial staff together with the Polytechnical School of São Paulo University. It provides substantial programmes for lectures and training courses for graduates and postgraduates.

The general conclusion to be drawn from the result of the investigation is that IPT has to be rated as a very suitable center for intensifying the national technical research activities and to adjust the quality of national research output to the international standard. This is in perfect accordance with the opinion of the representatives of the State and the Federal Government.

The information provided agrees with the impressions gained during the field surveys and may be summarized as follows:

- In view of its attitude, external activities and educational and training functions IPT may be regarded as a university institute

- In the opinion of both the Superintendence and nearly all division heads IPT is to be regarded as a contract research institute

- According to the present structure of the extra-university functions IPT may be defined as an adequately qualified materials testing laboratory with small-scale contract research activity.

Considering origin and history of IPT, the present unique and problematic situation has to be regarded as a transition stage from a university institute to a contract research organization efficiently operating on its "market", in which IPT is no longer the first and has yet to become the latter.

The outcome of this transformation process depends to a large extent on the motivation and necessary re-orientation of the philosophy of all IPT staff members.

3. Internal Organisational Set-Up

3.1 Legal Status

IPT - its history reaching back as far as 1926 - has been formed as a legal entity of its own, yet annexed to the Polytechnic School, by a "Decree-Law" of the Governor of the State of São Paulo in 1939. Its present legal basis is Decree Law No. 52.644,[1] issued February 3, 1971, which transformed it into an "autarquia" (autarchy).

Although still associated with the State University of São Paulo, IPT is now an autonomous institution. The status of "autarquia" is a form preferred for a public entity created and sustained by the State to develop activities not suitably managed by direct administration. It secures, on account of the principles of "indirect administration", a rather independent status, though other legal possibilities of the Brazilian legislation - a foundation or a mixed company - would ensure still more independence.

The following dependencies remain:

- Management: The Deliberative Council, including IPT's Superintendent, is appointed by the State Governor (for details see under 3.5.2, page 27).

- Organization: The organizational set-up, description of the functions and responsibilities of the various management levels and staff members, working regulations, etc., and subsequent changes thereof must, in principle, be approved by the State Administration.

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1) See volume of documents, No. 1, with the annexed "Regulamento do Instituto de Pesquisas Tecnológicas").

- Financial affairs: The annual budget has to be elaborated in accordance with the bureaucratic rules of State Administration; all expenses are subject to the special accounting rules and fiscal controls of the "Secretaria da Fazenda" (Finance Secretariat); the payments of he State to IPT require political approval.

- Salaries: salaries are - in principle - subject to the State tables, whose level is lower than that in industry.

The influence of the State is, therefore, rather strong and suggests a considerable element of bureaucratic style. It may thus seem difficult for the management to direct business policies in such a flexible and dynamic way as may be necessary in the interests of the Institute's successful growth, especially considering its long term development.

Actually, under present conditions, there is no noticeable negative influence of the State on business policy or on management and organization, if such of a purely formal nature is neglected. The policies and responsibilities laid down in the "Regulamento" may even be seen as a positive element of long term planning; necessary organizational changes may easily be realized, either within the limits of the "Regulamento" or by adapting it to new requirements without undue difficulties. Organization charts and internal regulations are, in any case, worked out by IPT itself.

Negative effects of the autarchic status, however, may be attributed to its special kind of budgetary control and fiscal regulations and to the salary policies enforced by it.

The fiscal controls are of a formal and bureaucratic nature. The following is an example of the consequences of the budgetary rules:

The budget may never be exceeded even when increased costs would arise from additional research contracts and would be covered by additional revenue from these contracts. The budget would thus prevent IPT's expansion financed by its own merits. To find a way out of such senseless restrictions, manipulations might be necessary as shown in the foot-note, on page 21 , concerning the "convênios" (agreements). In addition to this, too much fiscal thinking in financial matters may have impeded development of an effective cost accounting so far, though certainly it cannot prevent introducing a suitable system of cost accounting.

The low salaries paid up to 1971 according to the State tables, lead to a heavy drain on the human resources of IPT, due to the much higher salary level in industry. The negative effects have been considerable, because without a sufficiently large proportion of experienced staff members the Institute is not able to keep up the necessary level of quality (see under 3.3, page 23). As in the case of detrimental budgetary regulations, a way out has been found: Since march 1971 premiums are paid in addition to the salaries according to the state tables. This precedure, however, does not seem to have an adequate legal foundation. Therefore special tables like those to be found in comparable institutions in Brazil should be introduced to replace the state tables plus premiums.

Another drawback of the present status is, as the superintendency presumes, that industry and the federal government might be reluctant in sponsoring projects with an institution too much dependent on the State.

Our contacts with the industry did not confirm this presumption. This attitude might be due to the fact that IPT is known primarily as a test institute and might change with the kind of research carried out. To our opinion, however, this aspect will be of minor importance for some time to come.

Conclusions

The present status has several great disadvantages; it offers, however, sufficient flexibility by not preventing further positive development. Nevertheless it may be assumed that, in the long run, only an entirely self-governing institute - preferably in form of a foundation - which is also formally free to determine its future, would maintain the self-assurance and confidence required for its successful operation. The close connections with the Government, especially necessary in a developing country, could be secured by including ex-officio one or two high officials of the relevant ministries in the "Deliberative Council" or the "Board of Trustees" of the Institute.

However, the State Government will certainly feel more responsible for IPT having the status of an "Autarchy" than if it were a foundation. For this reason a conversion into a foundation should only be effected if a special revenue, comparable to the contributions of the State, can be secured for all future. A research institute completely dependent on contract revenue will not be able to fulfill its commitments with regard to the training of personnel and basic research necessary for long term development. It will be much more liable to lose independence for different reasons, to a much larger extent.

It is recommended to change, as a medium termed measure, the relationship between the Institute and the State, which is now characterized by a great dependency of the Institute to the "subsidizing" State, to a more business-like relationship on equal terms: research contracts with well defined working programs, time and cost should replace the State contributions. A requirement of such a change is a better project-oriented system of cost accounting (see 3.5.3.3, page 33).

The bureaucratic and not very efficient budgetary regulations will then become unnecessary. This would be the point of time to consider a conversion of IPT into a foundation, on the assumption that

- a reasonable influence and interest of the Government in the business policy is secured
- independent from any contracts closed, IPT's financial independance by revenue of its own is sufficiently high.

3.2 Financial Situation, Research Income and Price Policies

Invested Capital

On account of the inflationary development of recent years the official balance sheet of IPT gives no true picture of the invested capital. The following data are therefore based on a very rough estimation by the IPT (real values in 1971):

land	34	million	Cruzeiros
buildings	8	"	"
equipment	20	"	"
	62	"	"

This is equivalent to about 11 million US $. It should be the minimum value of the invested capital.

Financial Development, Contract Research Income and Subsidies

The financial situation has developed as follows (including budgeted values for 1971 and 1972):

Finan ial Development, Contract Research Income and Subsidies (in 1000 Cruzeiros)

	1966	1967	1968	1969	1970	1971	1972
	(revaluated in prices of 1970)					(according to budget)	
A. Contract research revenues							
- "convênios" for technical assistance[1]	-	-	-	359	1,192	4,000	5,500
- tests and analyses	2,714	2,064	2,481	1,887	2,983	5,100	6,800
- others (experimental production, publications etc.)	613	291	378	408	768		
	3,327	2,355	2,859	2,654	4,943	9,100	12,300
B. Subsidies of the State Government							
- for current expenses	5,358	2,740	5,856	5,812	8,612	13,500	11,800
- for investments	-	1,572	867	1,917	1,560	4,500	4,500
	5,358	4,312	6,723	7,729	10,172	18,000	16,300
C. Total	8,685	6,667	9,582	10,383	15,115	27,100	28,600
D. Investments for the chemical centre (financed by Mitsou, Japan)							13,000
							41,600[2]
E. General price index	42.6	54.7	67.9	82.0	100.0	.	.

1) includes 100 % of the convênios, of which only about 40 % are contained in the official budget.
See footnote 1 page 21

2) Additional subsidies for the BID-project of about 4 mill. cruzeiros are expected

The development is strongly influenced by the salary level; about 70 percent of the expenses may be salaries, which often were adjusted to the inflationary development with a considerable lag. This explains the quasi decrease of the research volume in 1967.

Up to 1968, the investments have been fully financed by subsidies. Subsidies for the current expenses have been curtailed by IPT's own budgeted revenue.

Since 1969, part of the investments required for work carried out within the scope of the "convênios" has been financed from the revenues of the "convênios". Thus, it is no longer possible to determine the total investments made from 1969 onwards.

The percentage of total expenses financed by own revenues has been increasing substantially since 1969 (in %):

	1966	1967	1968	1969	1970	1971	1972
Own revenue	38	35	30	26	33	34	43
Subsidies	62	65	70	74	67	66	57
	100	100	100	100	100	100	100

This favorable development is mainly due to the new procedure of contracting "convênios" with industrial sponsors. Within the scope of the "convênios" IPT renders technical assistance to the sponsor, sometimes on a broad and in ad-

vance not narrowly defined scale; time and funds are usually fixed[1].

For 1972 the subsidies of the State have been cut rather sharply. The own revenue forecasted is an optimistic estimate; the estimated amount is necessary to prevent stagnation in the development of IPT.

To finance an increasing proportion of its activities by its own revenue, is and should be an important part of IPT's business policy. However, it would certainly be an additional incentive to the growth potential if an increase in its own revenues would not be followed by a curtailing of subsidies to the same extent.

Price Policy

The costs of routine tests are charged to the sponsor according to a price list comprising more than 3,000 items, which is revised annually.

It is to be assumed that in many cases pricing is very discretionary as there is no cost accounting to be used as a basis. Views differ as to what extent real costs are covered by prices.

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1) So far 40 percent of the total sum of a "convênio" has usually been included in the official budget of IPT, which has to be approved by the State Government. 60 percent have been kept available on a special account of the sponsor; it is, however, at the free disposal of IPT to cover 60 percent of the costs of the "convênio", and it is not subject to the rules of public accountability. This way of handling the financial side of the "convênios" gives IPT a wider financial margin than the administrative rules provide.

It seems that in some cases prices charged may not even cover direct costs; they may tend to lag behind the inflationary development.

Revenue from services rendered within the "convênios" will probably be closer to the actual cost: material and equipment bought for activities covered by a "convênio" as well as salaries paid to personnel engaged especially for it are directly invoiced to the sponsor.

Only very recently compilations of direct costs for some "convênios" have been carried out for the first time, to permit a subsequent control of the actual costs incurred.

Often the actual determinants for the price level are not the costs - however marginal - but the "market": clients, who consider the prices for tests to be too high or who have some definite ideas of how high the maximum hourly rates billed under the "convênios" should be at the utmost.

Too low prices may be attributed both to the disinclination to bargaining hard for better prices and to a missing cost accountancy.

It is recommended to fix prices as far as possible according to the total costs. A calculation form should be used for pricing to unify methods and to show how prices have been computed. As long as no cost accounting is available, overhead for the fixed costs of the various divisions and of the Institute as a whole should be roughly calculated, and to be used in a uniform way by all divisions.

There may be exceptions from the principle of cost pricing, especially to promote use of IPT's services by the national middle and small industry. In this case, however, it should be noted to what extent actual price and cost price are differing.

Knowledge of this difference would enable IPT to better resist real or alleged disinclination of sponsors to refund full costs.

An internal policy to prescribe a minimum percentage to which full cost should be covered, can successfully be used as a means to initiate cost reducing actions and/or to negotiate better prices.

3.3 Staff

Number and quality of staff members developed as follows:

	1967	1968	1969	1970	1971
Professionals	90	108	148	177	213
Nonprofessionals	204	222	280	330	358
Administration*)	243	282	308	288	371
	537	612	736	795	942

*) including administrative personnel within the technical divisions.

The breakdown by divisions is shown in Appendix 1.

The turnover rate of the professional staff has - at some times - been fairly high. It reached its peek in 1970 and in the beginning of 1971 with about 17 percent. This has been due to salary levels being tied to the state tables (see 3.1, page 13). However, owing to the special premiums paid since March 1971 in addition to the state tables, salries have been increased by 40 to 50 percent. This has solved the fluctuation problem of the professional staff for the time being; for the non-professional staff, however, with partly also comprising highly qualified people, the problem is yet unsolved so far.

The effects of both the growth and the high turnover rate of personnel during the last years show also in the breakdown of the professional staff by period of employment and age (see Appendices 2 and 3). As it is very difficult for IPT to get qualified people with experience in industry, a very high percentage of newcomers are recruited directly from the university.

3.4 Physical Facilities

IPT owns premises of about 240,000 m^2, bordering on the campus of the university of São Paulo. About 40 percent of this is built-up area, so that there is sufficient space for extensions.

Administration and research facilities are housed in 30 buildings. New buildings for the Geology, Civil Engineering and Ore Treatment divisions are in construction. The new buildings and those in construction correspond to the international standard, part of the older buildings and laboratories have to be rebuilt or renewed. On the average the major part of the equipment is over ten years old and thus rather obsolete for research purposes.

For further details please refer to section 4 of the individual divisions.

3.5 Management and Organisation

3.5.1 General View of the Organizational Structure

The following chart shows the essentials of IPT's organizational structure (see next page)[1].
As almost any expanding organization IPT is subject to constant organizational modifications. For this reason the chart shows some units that are only in statu nascendi. This applies to the "staff", comprising at present three members, but planned to have eight members (for detail see 3.5.3.1, page 29), for the Center for Information Research (for details see 3.5.3.5, page 35), to the Scientific Documentation Division, which so far consists mostly of the Library Section, and to the Internal Auditory. The "Advisory Board" (= Junta Técnico Administrativa ITA) is composed of the Superintendent, the Vice-Superintendent and the Directors of the various divisions. Its functions are laid down in the "Regulamento" (see "Volume of Documents", Section VIII, page 9). According to the present practice they are mostly of a formal nature in connection with the rules of State administration. It might be advisable to use this board also for discussing basic questions of research activities and for promoting interdisciplinary cooperation between the technical divisions.

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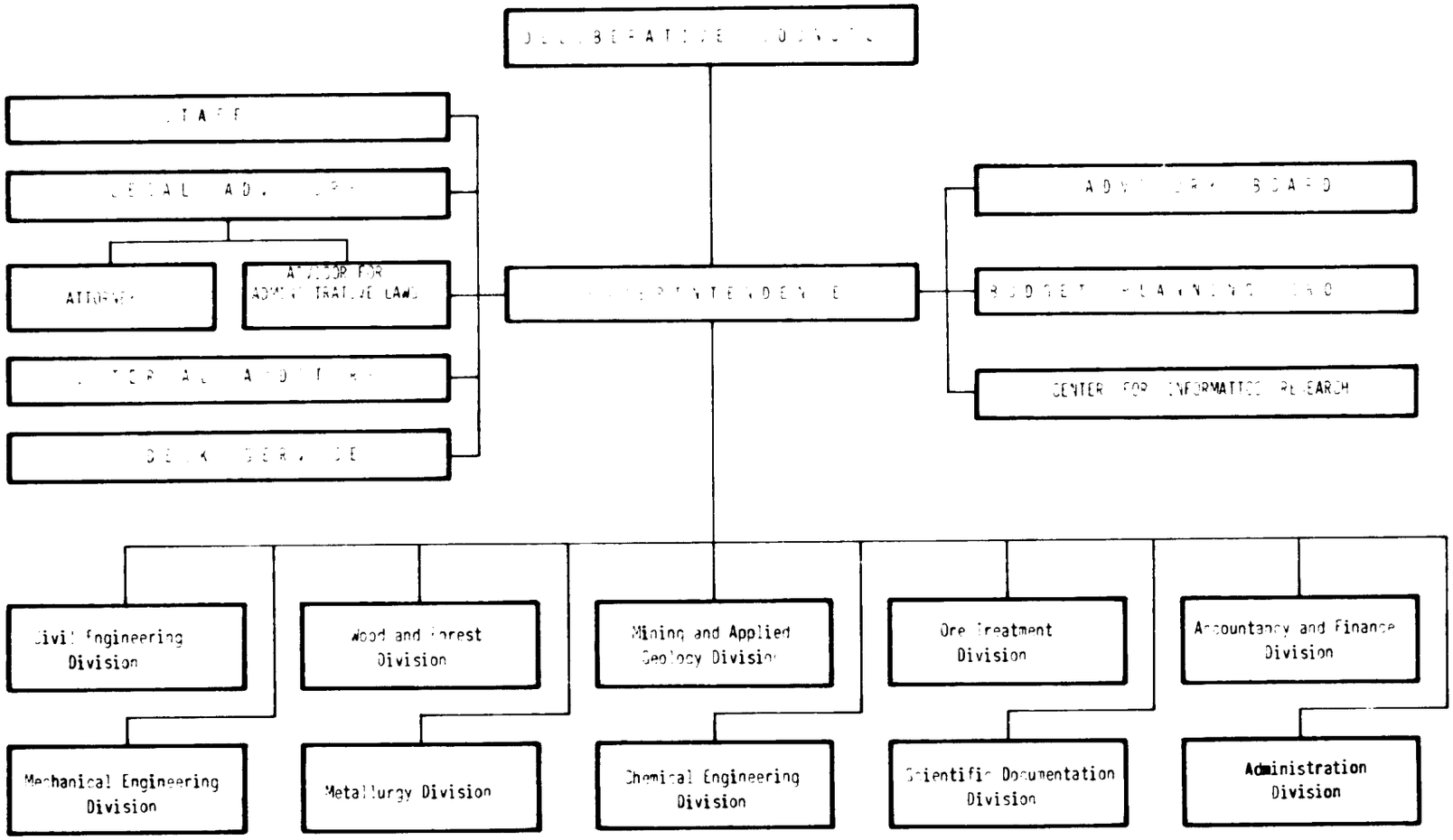
1) See Appendix 4 for a special chart of Central Administration and Services

TECHNOLOGICAL RESEARCH INSTITUTE



3.5.2 The Policy-Making and the Executive Function

The decisive functions are concentrated in the "Deliberative Council" ("Conselho Deliberativo") and with the Superintendent.

Powers and functions of the Council and the Superintendent are defined in the "Regulamento do Instituto de Pesquisas Tecnológicas", annexed to the above mentioned "Decreto" (see 3.1 page 13 and "Volume of Documents" 1, section IV).

The Council is composed of

- two professors of the Polytechnical School
- one representative of the "Federação das Indústrias") (Industrial Association)
- one representative of the "Instituto de Engenharia"
- one member proposed by the "Conselho Estadual de Tecnologia" (State Council of Technology)
- the Superintendent of IPT.

The six members of the Council are, after approval by the legislative assembly, appointed by the Governor.

The Council has important functions:

- It approves the business policy of IPT and the planning of activities presented by the superintendent
- It supervises the execution of projects
- It appreciates and approves the annual report
- It passes the annual budget
- It comments on salary policies

- It is heard on modifications affecting organization and working methods of IPT.

The highest executive of IPT is the Superintendent. He should be an engineer with technical and administrative training. He is also appointed by the Governor of the State. He has full powers in personnel and general administration, he is responsible for coordination and supervision of IPT's activities in accordance with the general and specific planning activity specified in the "Plano Director".

The Superintendent has a right being heard by the Governor when disagreeing with the Council.

Three members of the Council belong to the University and professional organizations; this suggests a preponderance of representatives of the technical community and the University, compared to the one representative of industry, finance and public planning.

Actually, the two present representatives of the Polytechnical School are actively engaged in industrial consulting. Thus the industry's interests and view points are represented more vigorously than might be supposed

Nevertheless, for some future modifications of the Council it might be advisable to include members of the industry, the finances and/or public planning organisations.

For an evaluation of the influence of State administration on the policy and executive functions see 3.1, page 13.

3.5.3 Central Administration and Staff Functions

3.5.3.1 Present Situation and Future Organizational Planning

So far, the functions maintained by the central administration have mainly been restricted to

- financial matters including billing and accounting and all questions connected with it on account of State regulations by which IPT is bound owing to its status of "autarchia"
- personnel administration
- advisory services on legal matters
- technical auxiliary services (library, transport facilities, canteen, power supply etc.)
- cultural relations, up to now mainly comprising lectures, post-graduate courses etc. to be held by IPT in connection with the educational program of the University.

About two years ago the "Budgeting Planning Group" was established to coordinate and carry work required in connection with the preparation of the annual budget of the departments and IPT as a whole. It comprises 9 members of the various divisions and one member of the State (of the "Secretaria de Economica e Planejamento")[1].

Many staff functions have not been established so far, or not yet effectively These are for instance: cost accounting, public relations, documentation, information and computer

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1) see decree about the establishment of such a group, Volume of Documents, No. 2

services, project development and contracting, evaluation of research projects, long-range planning (including planning of personnel and buildings).

The lack of staff functions and staff personnel have put too much responsibility on the Superintendent and the few available staff members. As a consequence many functions could, so far, not be exercised at all or not as intensively as required.

The Superintendent is fully aware of this state of affairs and has laid down the prerequisites for such a staff reorganization in the "Regulamento" (see Vol. of Documents, 1, article 21); provisions have been made for a staff of eight qualified people (as compared to three now available). As a supplement to this article "Rules for the Assessory of the Superintendent" have been laid down (see Appendix 5); they are to be approved by the Governor shortly. They are concerned in particular with

- public relations and coordination
- organizational aspects
- contractual services and pricing
- elements of long-range planning
- project control and project evaluation
- project development and implantation of pioneer activities
- documentation and information
- labor resources planning.

The important function of cost control and cost accounting is not mentioned in this catalogue.

So far, no details are available as to how these functions are to be defined and how they should be assigned to the staff members.

3.5.3.2 General Remarks on a Future Staff Organisation

Assistance by key technical and techno-economic personnel should be realised as quickly as qualified people can be found for the required functions. Detailed organization and assignment of duties will strongly depend on the special experience and abilities of future staff members. Five principles, however, should be observed, when working out organizational details to eliminate the risks inherent in any staff organisation:

(1) Care has to be taken that detailed job definitions are worked out for well defined tasks

(2) Annual activity programs should be prepared, covering the aims to be reached and the budget required by each staff unit

(3) Any mixing of responsibilities between different staff units has to be avoided (even now, with very few staff functions exercised the assignment of duties involves the risk of not clearly defined functions and competence)

(4) On the basis of a clear definition of functions, close cooperation of all staff members is to be promoted. But precise job definition and delineation of responsibilities should not exclude the possibility to make use of every specific ability of a staff member by transferring - in special cases - well defined tasks from one staff unit to another. A means to promote cooperation may be for instance: regular meetings of all qualified staff members, perhaps once a month or every two month, offering the

opportunity of contacting each other on an informal basis (possibly together with the division heads); regular meetings on a more formal basis, where in turn one of the staff members will report on the progress made in his work, with a subsequent discussion of problems, perhaps every three months; one meeting each year discussing and establishing the annual programs.

(5) Care should be taken that such activities of the staff organization, which are becoming routine work should be delegated to the central administration or to auxiliary services. The staff occupied with activities requiring a high qualification should be kept as small as possible.

Staff organization offers no specific problems, if the staff members' activity

- is aimed at supporting the general management
- is primarily related to external contacts
- is aimed at centralising functions that do not belong to the actual competence or to the central activities of the technical divisions (as cost accounting, contractual services, documentation, or coordinating functions in long range planning etc.)

Specific problems of staff organisation arise in connection with the aspects directly related to the central fields of activities of the research divisions, such as project development, project evaluation, project control.

There is the risk that cooperation will not work satisfactorily and will lead to constant frictions, a mingling of responsibilities and as a result inefficiency, or that the staff will lose contact with the divisions and will not be able to fulfill its functions. The best way to avoid this danger is that the managerial staff members find ways to introduce the missing abilities - e.g. project evaluation - into the research department by training the research personnel in necessary new techniques, and by developing organizational procedures and control methods to facilitate and ensure application of the new techniques by the technical staff itself.

3.5.3.3 Cost Accounting and Cost Control

There is no cost accounting so far, by which costs can be assigned to research projects or test programs, etc. The only existing cost control is the limitation of expenses by the formal budgetary control.

The Superintendent took measures to secure the staff capacity for implementing cost accounting, by promoting staff personnel to be trained in cost accounting and business administration.

As a first step time sheets have been introduced in two departments on an experimental basis. This has, however, been done more by divisional initiative than by central planning[1)]. No precise ideas what a central cost control system should look like do exist so far.

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1) Some simplifications in the above mentioned time sheets are recommended, as cost accounting need not be so detailed and should - for practical purposes - be kept as simple as possible

Cost accounting is necessary

- to promote cost consciousness
- as a basis for pricing and price policy
- for the efficient execution of research projects: the assignment of costs not only to cost centers, but to projects, permits the introduction of pre-planning of time and cost for the execution of projects - a necessary requirement for promoting efficient research
- as a basis for rational decision-making, especially to prevent wrong investment decisions
- perhaps to become more independent of state subsidies by replacing subsidies by contracts concluded on the basis of the cost incurred .

It is recommended to establish cost accounting as an important element of modern management policy. Care should be taken that the system introduced is not too sophicticated. A simple system is to be preferred to keep costs of cost compilation as low - as possible - and to make it easily understood by the staff.

As an example, a cost accounting system suitable for the purposes of IPT has been elaborated; it is shown in Appendix 6.

3.5.3.4 Public Relations and Industrial Liaison Functions

Owing to the importance of these functions they are dealt with separately in a special section of this report (see Section 5 Liaison)

3.5.3.5 Documentation, Information and Computer Utilization and Services

Present situation

There is no central documentation for the purposes of IPT. The library procures books, periodicals and copies ordered, but without a special service providing information about what kind of material in a special field is available and where it can be procured.

The divisions have documentations specialised for purposes of their own (for details see under chapter 4). But often the members of the divisions are dependent on themselves when needing special information.

So far IPT has no computer of its own. However, a group of experts is being specialised to solve scientific and technical problems through computer techniques. If necessary, outside computer services are utilised. A list of present computer applications at IPT is enclosed in the annex (see Appendix No. 7).

Program for establishing a special "Center of Scientific and Technological Information" within IPT.

In November 1971, IPT has submitted a proposal to the State Government for establishing a "Centro des Pesquisas Informáticas" (CPI) within IPT.
The proposed center would not only take care of the documentation and information requirements of IPT. Its purpose is much more far-reaching. For this reason it can be regarded not only as a staff unit within IPT, but must also be seen as a comprehensive unit with an activity of its own, surpassing other divisions in personal strength within a very few years. However, for practical purposes it is discussed in all its aspects in this chapter.

Reasons for and scope of the planned Information Center

The planning of the center starts from the fact that for Brazil adequate information channels are a necessary requirement in the promotion of technological development. Scientists, technologists and the industry have at present an urgent need for information services; previous experience is necessary for the preparation of plans and the choice of new investments.

As a consequence, it is necessary to prepare and train people in the various aspects of informations science, so that modern systems of information storage and retrieval may be designed and operated.

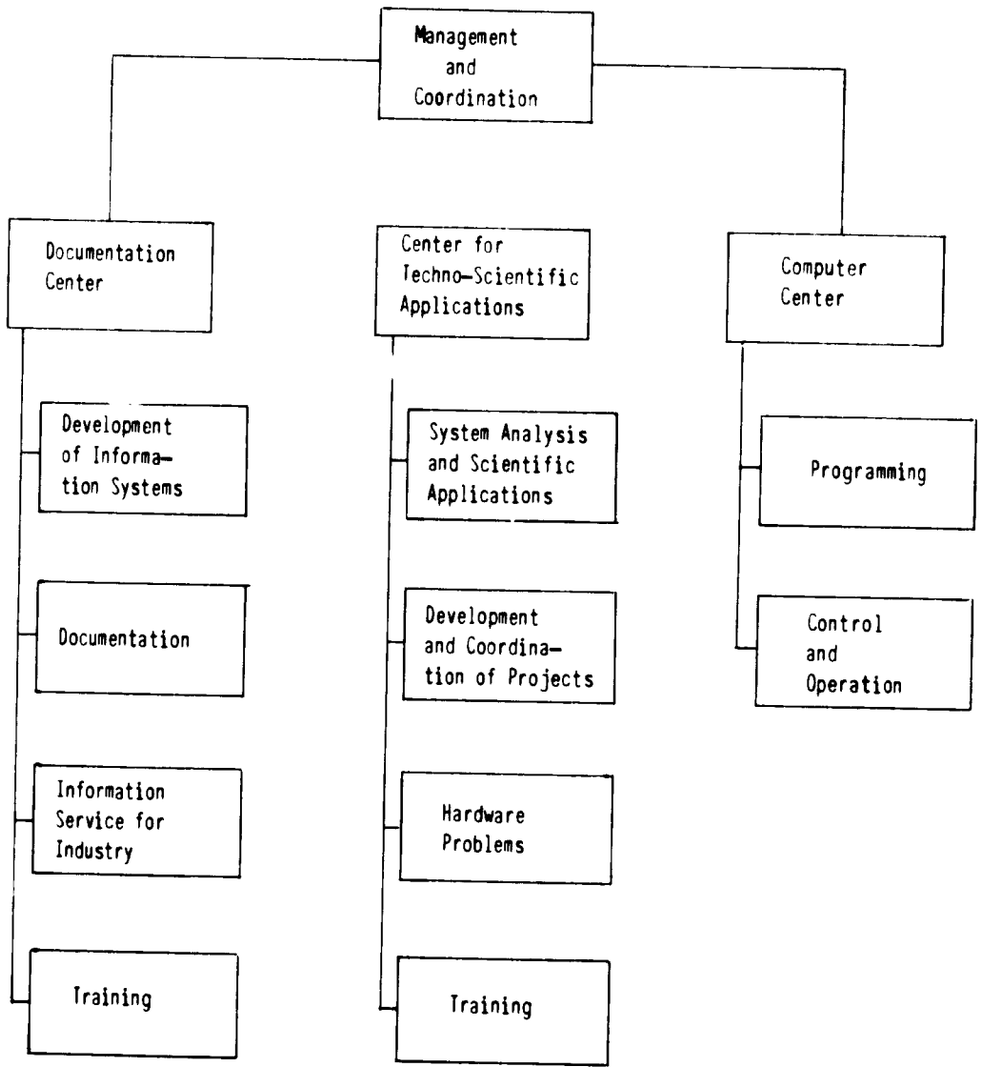
Thus, the proposed information center has the following aims:

- Preparing and training people in information science and computer usage
- Developing information systems and software for information storage and retrieval
- Offering different information services to the industry, based on the documentation of the centre as well as on the technical staff of IPT; as a consequence an important liaison effect is anticipated by IPT
- Availability of computer experts for the technical staff of IPT and clients from the industry and the government
- Solving scientific and technical problems through computer techniques

The project is supposed to strengthen IPT as a whole by developing new areas of research and forming new links with the industry.

Organization and size

The following chart shows the proposed organization of the center:



The objectives of the three parts are different, but they are dependent on each other. Cooperation is to be coordinated by the management.

Number of staff members (without office boys) is projected to be:

Management and Coordination	21
Information Center	42
Techno-Scientific Applications	42
Computer Center	41
	146

Projected costs would amount to nearly 6 million Cruzeiros for investments; current expenses would amount to 8.5 million Cruzeiros annually, after full implementation of the Center.

Evaluation of the proposed information center

The whole center is well planned in its various components, in its different purposes and functions and in their interrelations and reciprocal dependencies. Many important implications are considered.

There is no doubt that the aims of the center are of utmost importance to a developing country as far advanced as Brazil, as well as to IPT itself. A high return on investment in this field can be expected.

Some of the more important points are discussed in some detail:

Documentation

It is very reasonable that an efficient documentation service and - consequently - the training of people in information science should enjoy high priority. In Brazil most technical documentations covering the special fields of

activity of IPT are still at their early stage of development. Cooperation with the more important documentation centers, such as the "Instituto Brasileiro di Bibliografica e Documentacâo" of the National Council of Research (IBBDJ) and the "Instituto Nacional da Propriedade Industrial (INPI), has already been secured or is being practiced. For this reason, a "convênio" has been concluded with INPI.

In view of such an early stage of the documentation service in a country, science and information facilities will be promoted particularly effectively by a concentration of efforts on a project like that of IPT. This is not only to provide industry with the necessary information; it is also - under long-term considerations - to prevent an arbitrary spreading of many small "documentation centers" in later years, with an expensive duplication of efforts and an inefficiency of the resulting documentations.

This is not meant to monopolise technical information by IPT, which is neither desirable nor possible (IBBD has done preliminary work of coordinating documentation on a national basis). However, it means that the conditions for a maximum possible coordination of future efforts and planning are secured in a field where such a coordination is as important as it is difficult, if not impossible, once the priorities are wrongly placed. There are many examples of this in industrialised countries.

A list of some documentation problems to be tackled by the center in the short run is enclosed in the annex (see Appendix 8).

System analysis (Center for Techno-Scientific Application)

System analysis as a separate field of activity of the Information Center might well prove to be a most important incitement to the development of IPT.

System analysis - among other aspects not mentioned here - is an important means to promote multidisciplinary research. This applies to the cooperation of the technical divisions. It applies still more to the necessary consideration of economic, social or psychological factors by systems analysis, - understood in broad terms - in addition to the purely technical factors for conducting technical research.

These aspects are of great importance because they are often decisive for the success or failure of the transfer of technical knowledge from industrial countries to developing countries or the transfer of the results of technical research of IPT; they are likewise important for project definition and project evaluation.

The manning table proposed for the "Center for Techno-Scientific Application" shows no details about the professional training of its staff, contrary to the "Management" and to the "Documentation Center", where 5 economists or techno-economists and one sociologist are scheduled. It is very important to include in the above center techno-economists or economists and perhaps a sociologist as well.

Computer Center

For a computer with 250,000 bytes and 6 magnetic tape units the amount of Cr$ 2,160,000 (nearly US $ 400,000) is budgeted as an annual rent. This means a rather big computer.

IPT intends to avoid the risk of unsufficiently economical operations by using outside computer services as before until sufficient utilisation of the capacity of a big computer

of its own is guaranteed (in 1971 the computer hours used by IPT have been 5 times higher than in 1970; further growth has been impeded by lack of a sufficiently large computer center). Subsequently a sufficiently modern computer put out of use by the industry shall be rented. At the end of the first year of full implementation a cost study shall show if the purchase of a big computer of most modern make is to be preferred to renting.

Acknowledging the fact that training in computer usage is a most important aim, it should be noted, however, that the risk of misappropriation of funds in the field of computer utilisation can hardly be exaggerated. Special attention should be payed to the following aspects:

(1) It seems that the computer center is not only regarded as an important component of the information center - which it is certainly - but also as an indispensable component for most of its activities - which it certainly should not be.

Information storage and information retrieval is and will not be - at least for some time to come - computer-based for most fields of technological documentation. The computer is one of several possibilities and - in most cases so far - not the most suitable one. This holds good for industrialised as well as for developing countries.

For these reasons one of the foremost responsibilities of an information center conceived also as a training center is to bring home this fact to all its more qualified members and trainees. As a result, these have to be trained in a critical attitude and alternative methods, as well as in techniques of unbiased decision-making with regard to the best tools for documentation and for administrative and scientific purposes.

A prepossession for the computer would result in a very expensive capital drain.

(2) For training purposes it is much better to use a small, but modern computer, as currently used in the industry, than a big computer, beginning to become outdated. In addition, it is easier for experts trained on small computers to adapt themselves to bigger ones than vice versa.

(3) Profitability of computer application judged primarily in terms of sufficient utilisation of capacity is misleading. Technical perfection of documentation by computer usage is very expensive, and costs are skyrocketing when - as usually done - the aim is ultimate perfection. Thus, unless renunciation of the computer for a special area is the best solution, renunciation of perfect computerisation mostly is. A less sophisticated system is in many cases much cheaper and therefore, in the end, more effective.

This holds good so much more so as there may be not many fields of documentation in Brazil, where the demand for information will be sufficiently high to justify expensive methods[1)].

After all, to have - in a certain time or at a certain cost - 50 percent of important information available in, for instance, 10 fields will in most cases be more advantageous than to have 90 percent of important information available in two fields. And this will frequently be the alternative.

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1) There are on the other hand, reasons to assume that the demand for information may tend to be higher in Brazil than in fully developed countries under comparable circumstances, as other sources of information will be scarcer.

Cooperation with the technical divisions of IPT - Liaison function and liaison possibilities of the center

An important planning element of the Center is to make use of the extensive know-how of its technical staff. Part of the Center's staff is to be taken from the technical divisions for handling information problems of those special fields; staff members of the divisions shall be trained to assist the aims of the center within the divisions. In this way the CPI-Project is supposed to represent a strengthening action involving the whole IPT. It is assumed that the information service for the industry will provide new links with the industry and assist in the development of new areas of research.

It is recommended

- to pay special attention to the coordination of documentation work in technological fields on a national basis

- to consider all methods of documentation, not only as far as they are computer-based; only then it is possible to find out the best way of input, storage and retrieval of information for any special area of technology and to prevent the application of the computer for inappropriate purposes

- to engage a sufficient number of economists or techno-economists for the center, who do not regard themselves as computer experts or experts for technical matters, but as information or documentation experts or system analysts in the broadest sense.

- to train all highly qualified staff and trainees of the information center in the application of feasibility studies for computers, the elaboration of the best con-

figuration, in the preparation of various models for alternative solutions (e.g. with and without computer use), and the evaluation of the use of computer time on the basis of a cost-benefit analysis

- to plan the renting of a computer carefully, preferring in case of doubt a newer type to an older one, even if cost should be higher or capacity lower

- to take up documentation and information services at first for such areas which are better handled by traditional methods; to emphasize in information research studies on the compatibility of traditional and computer-based systems; to consider consequences of any computer-based systems under the aspect of new and more efficient equipment in five or ten years to come; to introduce computer-based information systems only on the basis of alternative cost calculations and realistic cost-benefit analyses, for which one of the more important determinant will be the quantity of demand for special information, considering future requirements as well.

3.5.3.6 Project Evaluation and Utilisation of Research Results

The technical divisions are responsible for the development of new fields of research. The functions of project development are decentralised and, apart from some legal advice or control in contractual affairs, in general no use is made of central functions.

As no members with economic or techno-economic background belong to the professional staff of the technical divisions, the divisions tend to judge and handle projects from the technical points of view only, easily neglecting economic and other important aspects.

This leads to a restriction of the scope of the research activity. In addition it may be most important for the extent to which research results are transferred to practical utilisation by the Brazilian industry.

A short analysis of 16 research projects of the years 1966 to 1970 made by us shows that in 6 cases (with more than 2,000 engineer's hours spent) transfer of results to Brazilian industry has succeeded, in 10 cases (with more than 4,500 engineer's hours spent) transfer has not been successful so far, or no information is available as to whether and where industry makes use of the research results published in scientific papers.

It seems that failure of transfer is mainly due to the following two reasons:

- There is no real demand for the methods or processes elaborated or they are uneconomical considering the size of production in the industry
- A continuity of efforts is lacking to secure transfer after the research results have been published in technical or scientific journals, perhaps aggravated by the fact that the requirements for the utilisation of the research results in the industry cannot be met (e.g. no trained personnel)

There is no systematic investigation and analysis made by IPT to find out the reasons for the failure in each case, with the purpose to work out efficient counter-measures.

These problems, however, are not unknown to IPT. In the "Rules for the Assessory of the Superintendent", item XXX of the scheduled functions (see Appendix No. 5) reads: "Organise and manage a permanent group for techno-economical evaluation of all IPT projects and study and define criteria of merit for IPT's activities and performance."

It is recommended that the staff of IPT is supplemented by techno-economic experts for the above-mentioned purposes.

Activity of a staff-member taking care of these aspects might comprise:

(1) Improved planning of projects by defining the ultimate ends of the project (in a broad sense) and considering all pertinent steps of the working-program necessary for achieving the ultimate ends.

(2) Evaluation of each project in terms of cost-benefit analysis

(3) Improved planning of research programs by setting priorities on the basis of item (1) and (2) and according to defined priority rules

(4) Analysis of utilisation of project results and reasons for failures of transfer

(5) Utilising results of the analysis according to (4) for improved planning of projects and research programs (feed-back)

The following implication may serve as an example: the ultimate end in the elaboration of a process for better quality and the setting of quality standards may be defined as the improvement of quality of the industry's production. Thus, the elaboration of a special process and the definition of the quality standards may not be sufficient to increase the quality level in the industry. For preparing an effective research program it may be necessary to determine before:

- the number of producers
- the size of production
- other possible processes for quality improvement

- necessary standard for home production and export
- production costs (or possibly their reduction) resulting from an improved standard
- advantages for the producer as a result of increased exports and/or higher prices

The planning of the research project has to consider:

- how to transfer the results; possible objections of producers or psychological resistance to the introduction of new processes, problems encountered in the introduction
- necessary support by the industry in the implementation of better quality (technical training, investments)
- possible handicaps of the industry to profit by better quality (e.g. missing export promotion or willingness to export at all)

Finally, it might be necessary to define, what steps in a complete program for the improvement of quality in a sector of the industry are outside the competence of IPT and, following it, to consider how cooperation with state agencies or such institutions authorised or qualified to carry out those steps can be secured.

It is important that the staff member handling these problems should himself feel responsible in helping the members of the technical staff to consider the cost-benefit implications of their work, rather than to look at his activity as being of a supervisory and controlling nature. So as a result, he might

- prepare standard proposals
- elaborate general standards and checklists with the above items for the preparation of programs for research projects as an aid to the technical staff
- elaborate methods and checklists with the above items for the assessment of projects with regard to the transfer of results.

Control procedure may be limited in the end to the examination of checklists to be submitted for each project for approval by the Superintendent.

As systems analysis may be used as an important tool for detailed project evaluation and definition, cooperation and delineation of functions with the "systems analysis group of the Information Center" will be necessary.

The technical staff member may not be in the position to deal with all the above-mentioned questions, which may be relevant for the programming of a project; thus it would be up to the economic capacities of the central staff to carry out market research and other economic investigations necessary for a comprehensive project evaluation.

A staff function with the above responsibility may prove to be a starting point for a separate techno-economic division, as soon as techno-economic studies are required by sponsors from the industry and the public sector.

4. Survey of the Research Activities and Evaluation of the Current and Future Programs

In the technological sector IPT has the following seven divisions arranged by scientific disciplines:

1. Metallurgical Division
2. Mechanical Engineering Division
3. Civil Engineering Division
4. Mining and Applied Geology Division
5. Ore and Mineral Treatment Division
6. Chemistry Division
7. Wood Division

For many years IPT has been more or less a pure test laboratory for quality and materials evaluation. In the last few years there has been a certain development from pure test work toward research work.

In the Brazilian industry, IPT has an excellent reputation as a test laboratory, and it passes as the best test institute of São Paulo state and the whole of Brazil. It is not recognized as a research institute.

In the past routine and test work covered about 70 to 80 percent of the capacity of IPT. The balance of 20 to 30 percent covered in-house research work and to a smaller extent contracted research.

IPT's management is interested in increasing the volume of research work. It is planned to train skilled staff to carry out the routine and test work. The graduated personnel is intended for research work. The increase in the volume of research work is aimed at applied research rather than at fundamental studies.

In the past the Brazilian industry bought its know-how from the industrialized countries in Northern America and Europa. Now the industry has reached a level at which it is able to undertake its own research work to reach international standards.

There are numerous examples demonstrating that national Brazilian industrial development is able to be carried through on an international scale and to get broad acknowledgement, including: the development of the VW 1600 do Brazil; the construction of big dams by national companies; developments in the field of special machine tools (in 1971 Brazil exports special machine tools to the USA about 100 million US $ totalled). "Research earns money". This thesis is widely accepted by the Brazilian industry. IPT as a well-known test institute is ideally suited to become also a research center for the Brazilian industry.

Interviews with the division chiefs of IPT showed that the problems of the various divisionsare quite different. A questionnaire was prepared and distributed to the divisions. The resumee of this questionnaire and of additional interviews is summarized in the following section.

4.1 Metallurgy Division

4.1.1 Personnel and Organisational Structure

The Metallurgy Division employs 117 people and is subdivided into:

- Administration
- Foundry pilot plant
- Chemical metallurgy group
- Physical metallurgy group

The administration covers the director of the Division, the technical staff, the budget control group, support and auxiliary services.

The foundry pilot plant carries out

- Iron casting
- Steel casting
- Non-ferrous alloys casting.

The chemical metallurgy group covers the foundry laboratory, the casting laboratory and the powder metallurgy laboratory.

The physical metallurgy laboratory comprises the laboratory of metallography, laboratory of commission and surface treatment.

The following Table shows the distribution of the personnel in the groups of this division classified by the professional background:

Employees Classified by Professional Background

Organisational Unit	Graduates	Skilled	Auxiliary	Administrative	Total
Administration	3	5	18	8	34
Foundry Pilot Plant	4	13	30	1	48
Chemical Metallurgy Group	8	5	4	-	17
Physical Metallurgy Group	12	3	1	2	18
Total	27	26	53	11	117

Appendix 9 shows the capacity and specialization of the graduate personnel including post-graduate studies in detail.

4.1.2 Facilities of the Division

Buildings

The space available is not very appropriate for the work in progress.

Laboratories

Sufficient space available

Equipment

In general the equipment was installed between 1955 and 1958. As a consequence it is obsolete from the technological point of view.

For the planned work, which is mentioned in paragraph 4.1.3 the following units of equipment are required. The list is not complete; only that equipment considered to be most significant for the future development of the Metallurgy Division was included.

Necessary Equipment

Transmission electron microscope;
scanning electron microscope;
X-ray diffractometer;
high-vacuum coating unit;
extrusion press;
liquid nitrogen plant;
dilatometer;
microtome;
quantimet (for quantitative metallography);
oxygen and nitrogen analyser
crusher and classifying system;
high-temperature furnace with Mo resistance;
electric permeability meter;
compactability testing apparatus;
1 ton vacuum melting furnace (production)
500 kg induction furnace;
microbalance;
equipment for continuous composition measurements of H_2/H_2O mixtures.

high-precision tensile testing machine;
high-precision electrohydraulic fatigue testing machine
microprobe X-ray analyser;
atomic absorption spectrophotometer;
thermobalance;
50 ton briquetting press;
continuous briquetting press;
reduction furnace (for briquette production);
hydrogen analyser
15 kW induction furnace
universal strength machine;
sand surface testing apparatus;
hot shear strength testing apparatus;
100 kg vacuum melting furnace (research);
150 kg electroslag remelting furnace;
equipment for continuous compositionsmeasurements of CO/CO_2 mixtures;

Appendix 10 gives a rough survey of the main equipment available and ordered.

Machine shop

Only limited facilities are available; for this reason recourse is made to the machine shop of the Mechanical Engineering Division

Stores

Adequate for raw materials and products, but inadequate for general research work.

Maintenance

Inadequate, but a maintenance group is planned and organized at present.

Administration

Internal communication and information are inefficient. Especially the secretarial staff is not sufficiently qualified.

4.1.3 Fields of Activity

The activities of the Metallurgy Division can be classified by:

- independent projects
- "convenios"
- testing and "trouble shooting"
- pilot production

Independent Projects

The initiative for independent projects comes from the division. There are two main groups: technological projects, dealing with the development of a new technique or process used abroad but not yet in use in Brazil and research projects concerned with considerations on a topic which may be of future interest to the industry.

Convenios

"Convenios" are contracts concluded with a branch of industry, usually with fixed time and funds. They can be divided into two types:

- Service contracts on the testing of pilot plant production and "trouble shooting".
- Research and development contracts.

This is usually team work, the funds are provided by the industry. The problems are basically defined by the industry.

Testing and "trouble shooting"

Problems presented from outside, which require

- analysis of service failures
- quality control
- analysis of corrosion problems
- testing of moulding sand

Pilot plant production

Basically a job-foundry which accepts requests that cannot be handled by the home industry. Mainly technological problems are to be solved.

Projects completed and under way since 1-1-1970

Appendix 11 shows projects, which have been completed and are under way since 1-1-1970.

Appendix 12 provides a picture of the routine work of the Division. The financial revenue from this routine work amounted to about 58,000 US $ in 1970.

Development planned for the years until 1975

The development planning of the Metallurgical Division is primarily based on the research and development projects listed in the following Table:

Development planned for the next years

Physical Metallurgy

- Organization of the Physical Metallurgy Laboratory

Chemical Metallurgy

- Studies on advanced processes for the production of the special steels and high-temperature alloys
- Pre-reduced iron ore for steel-making and iron powder production
- Precision casting by the lost wax process: development of raw materials, casing methods and products

The Physical Metallurgy Laboratory will cover several activities related to physical metallurgy and will have up-to-date equipment for fundamental research. The following activities have been planned:

- Corrosion and electro-deposition of metals
- X-ray diffraction and microprobe analysis
- Solid state reactions (heat treatment)
- Plastic deformation
- Welding process
- Electron microscopy
- Conventional qualitative and quantitative metallography
- Mechanical testing
- Non-destructive testing

The objective of this laboratory will be to train personnel and provide scientific support for materials, research, process and quality control, and research and development studies.

For the physical metallurgy group the following technical projects have been developed or planned:

- Rolling for clad-metals production
- Stress-corrosion of brass on organic media
- Fabrication of anoeds for cathodic production
- Deep-drawing of low carbon steels
- Heat-treatment of tool steels

The other projects listed pertain to the chemical metallurgy group whose activities will be organized as follows:

- Conventional foundry technology
- Ceramic mould casting process
- Ferrous extractive metallurgy
- Applied metallurgical and physical chemistry
- Non-ferrous extractive metallurgy
- Preparation of ferrous and special non-ferrous alloys
- Heat transfer in metallurgy

The next years these activities will be based primarily on the following specific projects, in addition to the projects mentioned above:

- Extractive metallurgy of niobium
- Kinetics of the interaction between Fe-C alloys and alumina crucibles under vacuum
- Optimization of modular cast iron structures
- Preliminary studies on the physical and chemical properties of slags
- Mould and crucible materials for titanium casting
- Desulfurization of iron for modular cast iron production
- Control of cast structures of austenitic steel castings by inoculation techniques
- Study of the influence of the basicity of the sinter on its reducibility

Pilot Plant Foundry

The Pilot plant foundry of the Metallurgy Division is planning to install a complete line to equipment for the production of castings by the shell process. For a regular experimental production of special castings on the basis of this process it is necessary to modernize in particular the melting, cleaning and finishing facilities of the pilot plant. At present there are no written plans for this development, but they are envisaged for the next years.

Estimation of Future Requirements for Research in Metallurgy, Iron and Steel

The future requirement of the iron and steel industry in Brazil is shown in the following table:

1. Engineering of iron- and steel-making plants
2. Improvement of Brazilian metallurgical coal
3. Methods of direct reduction of iron ore
4. Scrap substitutes
5. Pre-reduced iron ore
6. Methods of raw materials preparation for blast furnace
7. Development of high-strength structural steels
8. Rimmed steels for deep drawing
9. Development of weathering steels
10. Surface quality control of thin cold-rolled sheets

Extractive metallurgy of non-ferrous metals

1. Vacuum or electroslag processing of alloys with small proportion of non-metallic inclusions
2. Processing of tool steel
3. Processing of steels for special dies
4. Processing of special structural ferrous and non-ferrous alloys for nuclear and aeronautic industries
5. Processing of "super-alloys" for turbine blades
6. Development of special alloys for chemical and petrochemical industries
7. Development of tough materials

Foundry techniques

1. Special foundry processes (investment and precision casting, shell moulding, etc.)
2. Development of non-conventional moulding materials
3. Methods of special cast irons processing

Metalworking

1. Extrusion techniques of ferrous and non-ferrous metals
2. Forging of nickel refractory alloys

Others

1. Development of methods for surface protection of metals against corrosion
2. Engineering of cathodic protection
3. Electrodeposition processes of non-conventional metals and alloys
4. Hard facing
5. Modern welding techniques
6. Non-conventional thermo-chemical surface hardening processes

4.1.4 Comments for further activities

The situation of the Brazilian steel industry is characterized by two important factors:

- large iron ore deposits, mainly in the ferriferous Quadrangle of Minas Gerais
- an already important consumer market with a fully developed automobile industry and with other industries, such as building, household gears and packaging, whose importance is increasing.

In view of these circumstances the Brazilian Government decided to make the country independent from steel imports by erecting new steel production facilities or expanding existing ones. The output of 20 million tons envisaged for 1980 would enable Brazil to supply South America's steel market.

In the current expansion plan particularly the production of the three large companies SCN, COSIPA and USIMINAS, will be doubled until 1975 and further increased in the second half of the decade.

Extensive research work has to be done to achieve this growth, but where should priorities be set?

Domestic iron ore resources are much larger than required by the Brazilian steel industry, even looking at 1980. This enables Brazil to become one of the biggest ore suppliers of the world. Existing mines have modern equipment and are exploited on rational lines. Nevertheless, exportation of the raw ore is unsatisfactory, both from the financial point of view and the employment situation.

This situation may be improved by exporting iron ore, which has already been pretreated, for instance by pelletizing and prereduction.

Prereduction seems to offer some advantages in Brazil. The quality of the Brazilian ores is good because of the high iron content, and both fuels and reducting agents are available at low prices. In addition, a concentration of steel production on few big facilities based on blast furnaces may bear some problems, such as the necessary importation of coking coal and difficult distribution of steel products due to the transportation distances. This complex problem of iron ore beneficiation and prereduction needs further close investigation.

It does not seem suitable to develop research activities in conventional process technologies, such as coke oven, blast furnace, BOF and continuous casting, since all of them have already reached a high degree of technical developments. Of course, any optimization, such as the reduction of coke consumption, better process control, etc. should be aimed at, but the Brazilian steel industry is doing this continuously.

For this reason, emphasis in research should be placed on the field of finished steel products, consider the actual market structure; flat products like deep drawing sheets and coated sheets are of particular interest. Here there is yet much work to be done in the development of new techniques and the improvement of finished products by intensifying metallurgical research and using better quality control methods.

For these two research items - value adding for iron ore and improvement of the end products - it is necessary for IPT to establish certain priorities in the detailed investigation programmes and to coordinate investments with these efforts.

4.2 Mechanical Enginnering Division

4.2.1 Personnel and Organizational Structure

The Mechanical Engineering Division employs 72 persons and is subdivided into

- Administration
- Machine Tools Section
- Instrumentation and Control Section
- Material and Equipment Testings
- Naval Engineering
- Thermal Engineering

The following Table shows the personnel classified by professional background:

Employees classified by professional background

Organisation Unit	Graduates	Skilled	Auxiliary	Administration	Total
Administration	2	2	10	6	20
Machine Tools	7	7	4	-	18
Instrumentation and Controls	5	2	-	-	7
Material and Equipment Testing	5	2	6	-	13
Naval Engineering	5	4	3	-	12
Thermal Engineering	2	-	-	-	2
Total	26	17	23	6	72

Appendix 13 shows the capabilities and specialisation of the graduate personnel including post graduate studies in detail.

4.2.2 Facilities of the Division

The buildings of the Division are new and in good condition. The laboratories are well-equipped for the actual tasks. The stores are deficient owing to a lack of financial resources for the stock of raw material and standard parts. Maintenance and machine shops are good, only the administration is working inadequately because of the lack of qualified personnel. The documentation of the division is still incomplete, because the division is new and has not yet accumulated sufficient documentation materials.
The equipment is satisfactory. Appendix 14 provides a rough survey of the actual units of equipment.
For the immediate future it is necessary to equip the thermal engineering laboratories. In addition some machine shop equipment (jig borer, surface grinder, tool grinder, copying lathe, etc.) is required. Electronic computer facilities would be desirable.

4.2.3 Fields of Activity

In 1970 routine tests and trouble shooting covered 1,900 reports with about CR $ 600,000,-. Besides routine testing the Division conducted research work, and work contracted by convenios. The following Table shows the different research activities of the Division:

Fields of activities classified by the different laboratories of the division

Machine Tool Laboratory

- Analytical testing of machine tools
- Design and manufacture of machine tools
- Research on machine tool elements
- Industrial metrology

Instrumentation and Control Laboratories

- Design and manufacture of special electronic equipment for all research laboratories of IPT
- Design and manufacture of electronic, hydraulic and pneumatic servonmechanismus
- Design and manufacture of special hydraulic and pneumatic elements

Material Testing and Vibration Laboratories

- Mechanical testing of metals and alloys used in mechanical construction
- Mechanical testing of standard machine parts
- Dynamic tests of heavy structure, such as buildings, machine foundation, tunnels bridges, etc.
- Supervision of demolition work with explosives

Naval Engineering Laboratories

- Hydrodynamic tests of ship models, propellers, rudders
- Design of ship elements using numeric computation techniques
- Transport technology, group technology and production engineering problems, special fluid mechanic problems; thermal engineering
- Temperature measurements, heat transfer problems; compressed air technology; special combustion problems

Appendix 15 provides a survey of the projects completed and under way since 1-1-1970.

Developments planned for the years until 1975

There are two programs under discussion, one for the expansion of laboratory facilities sponsored by the Ministry of Planning and BID and the other for the expansion of the activities within the private industries, sponsored by the National Bank for Economic Development. However, the bottle-neck of the division is the shortage in graduate and skilled personnel to speed up the above mentioned programs and the program of the machine tool laboratory. The marketing of work already finished should be improved to secure transfer of research to industry.

Estimation of the industry's future requirements in Mechanical Engineering research

The market of the machine tool industry has now a volume of more than 100,000 US $ per year only for the replacement of the actual machine tool park of Brazil. The machine tool industry understands that research work is necessary, and IPT is the only institution which is doing research in this sector in the State of São Paulo.

The ship-building industry is continuously growing and requires close support of the naval engineering facilities, which are the only ones available in South America. The manufacturers of heavy equipment for the chemical and petroleum industry are urgently seeking for laboratory support for the development of their equipment.

4.2.4 Comments for Further Measures

The Brazilian machine tool industry is exporting special machine tools not only to the ALALC countries, but also to the United States. In this field the division needs more contacts with the industry. The actual research work in the machine tool sector seems to be too isolated and a close cooperation and teamwork with the industry is necessary. The transfer of research work from this division to the industry is insufficient. The division needs a staff of its own, which is responsible for the transfer of the research work. In addition, this staff should ascertain the industry demand for research. The bottleneck of qualified people must be eliminated by adequate social measures.

4.3 Civil Engineering Division

4.3.1 Personnel and Organisational Structure

The division employes 166 people and is organized as follows:

- Director's Office
- Technical assistants to the Director
- Auxiliary activities section
- Materials Group with
  - -- Concrete studies section
  - -- Materials studies section
  - -- Concrete laboratory
  - -- Materials laboratory
  - -- Chemistry of materials section
- Structures Group with
  - -- Structural studies section
  - -- Experimenting and observations of structures section
  - -- Static and dynamic testing laboratory
  - -- Analogical and mathematical models section
- Geotechnology Group with
  - -- Geotechnic studies section
  - -- Soils laboratory
  - -- Pavement laboratory
  - -- Soil reconnaissance and exploration section
  - -- Field observations section
- Environmental Technology Group
  - -- Macro-environment studies
  - -- Micro-environment technology laboratory
  - -- Construction productivity

For special activities, mainly research work groups are organized 'ad hoc'. At present there are two special groups, the transportation group and the subway group.

The following Table shows the distribution of personnel in the various groups classified by professional background

Employees broken down by Professional Background

Organisational Unit	Graduated	Skilled	Auxiliary	Administration	Total
Direction Administration	5	7	-	12	24
Materials	10	11	24	19	64
Structures	3	2	6	-	11
Geotechnique	14	16	27	3	60
Environmental	4	-	1	2	7
Total	36	36	58	36	166

For a listing of the graduate personnel by capacity and specialization see Appendix 16.

4.3.2 Facilities of the Division

Buildings

The division does not have a building of its own. Since 1954 there are only provisional installations in the administration building.

Laboratories

Those laboratories which are well-equipped are overcrowded others badly situated in provisional places; other simply do not exist so far, e.g. the structural and chemical laboratories.

Equipment

The only well-equipped unit of the division is the Geotechnology Group. The other is the Materials Group, but its present equipment is mainly designed for testing. Much more equipment is required for conducting research.

The Structures Group is well-equipped for outside work (observation and testing of full structures) and has some devices for model testing. The Environmental Group owns only anartificial sky for lighting investigations, and some acoustic equipment.

Most equipment ordered is to supplement existing equipment. Provision of additional equipment for the whole division is useless until the questions regarding the lack of qualified personnel and physical space are solved. It would be usefull to provide some equipment for concrete shrinkage research, for concrete creep research and for research on the wearing of industrial floors. There are necessary pilot plants for lime and cement production.

Machine shops

The division does not have any. The existing ones belong to other divisions. They are overloaded and well equipped.

Stores and maintenance

Fair to deficient

Administration

The offices are hopelessly overcrowded,internal communication and information are inefficient.

4.3.3 Fields of Activity

Nearly 80-90 percentof the work carried out in this division is routine work, because the division has been always a traditional test laboratoy for São Paulo's industry.

The number of certification tests carried out upon private and public request amounted to about 8,050 in 1970. The fields of activity are listed for each section in the following Table:

Fields of activity in each section and methods applied

Concrete Studies and Materials Studies Sections

These are dealing witch theoretical, or new, or not well-known technological problems encountered in the field of concrete, in particular, and in the field of construction materials, in general; this separation was made owing to the tremendous amount of concrete used in construction, because concrete is the most important construction material of São Paulo.

Concretesand Materials Laboratories

Both are concerned with the testing of concrete and materials

Chemistry of Materials Section

Research and testing in the field of Chemistry for all the needs of the Materials Groups, including concrete.

Structural Studies and Geotechnical Studies Sections

Both concerned with theoretical studies in the fields of Structures and Soils. Also with new mathematical and computing procedures in those fields.

Experiments and Observation of Structures Section

To carry out observations and tests on full existing structures from the standpoint of their behavior in service.

Static and Dynamic Testing Laboratory

Static and dynamic studies on prototypes and large models of structures of parts of these.

Analogical and Mathematical Models Section

Study models of structures through the use of modern techniques of analogical and mathematical simulation.

Soils and Pavements Laboratories

Concerned with testing of soils and pavements materials, respectively.

Soil Reconnaissance and Exploration Section

With drilling, sampling, and field tests in general.

Field Observations Section

Observation of the performance of structures on soil and of earthstructures from the geotechnical standpoint.

Macro-Environment Studies Section

Concerned with the technology of the environment in large areas (those which are covered by urban and regional planning). One important sector of this section is, at present, that devoted to pollution control.

Micro-Environment Technology Laboratory

Mainly concerned with comfort problems. Housing comfort is now a major concern.

Construction Productivity Section

To improve the productivity in the construction sites and plants. One major sector is that dealing with industrialized building.

All those laboratories and sections work according to the Brazilian or foreign (A.S.T.M., D.I.N., I.S.O., etc.) standards, well-accepted patterns, and, in the case of research or special studies, according also to previously planned procedures.

Projects completed and under way since 1970

This division is presently engaged in research projects and technical assistance for public agencies, which are governed by the following convenios:

Convenios

CESP - Centrais Eléctricas de São Paulo S.A. (for all needs in Civil Engineering Technology associated with big hydro-electric developments); FESB-CETESB - Centro Tecnológico de Saneamento Básico (idem, idem, associated with sanitation works); METRÔ - Companhia do Metropolitano de São Paulo (research on stresses and deformations of transitory and permanent supports, bracing, sheeting and lining of the subway works of São Paulo).

"Convênio" agreed with the agency in charge of the construction of the new super-highway between São Paulo and Santos, for the study of difficult geotechnical problems associated with the crossing of lakes by that highway through partially submerged embankments, which will be, at the same time, dykes or dams. The value of this "convenio" is estimated at Cr$ 150,000.00.
Another "convenio" with the same agency is under consideration for the purposes of studying geotechnical problems created by that highway, which is to cross softsoil low lands in the vicinity of Santos.

The costs are charged monthly according to services rendered or agreed upon.

An internally-sponsored research project is a 5 year project called "Habimas", whose objective is to establish a system for the mass production of houses. The project includes natural lighting studies using an artificial sky, which are expected to cover a period of 3 years at a cost of Cr$ 250,000. In the technical and sociological investigations on housing the needs and aspirations of the Brazilian people are considered. This sub-project is estimated to cover a period of two years at a cost of Cr$ 60,000.-.

In addition, the project includes investigations on housing patterns and costs, which are estimated with 3 years, at a cost of Cr$ 200,000.-.

Appendix 17 shows the projects completed and published since 1970.

Development planned for the years up to 1975

The completion of a new building before 1975 is yet uncertain. The shortage of space will prevent any significant development. However, owing to the present expansion of the building industry the development up to 1975 will go in the direction of heavy construction and high level design and planning. At the moment there is no spezified development plan.

Future demands of the industry

In a rapidly developing country such as Brazil, the demands of the industry and the government are as follows:

- Infrastructure planning
- Designing and building
- Technology for the heavy-construction industry
- Mass construction of the light- and medium-construction industry

4.4 Division of Mining and Applied Geology

4.4.1 Personnel and Organisational Structure

The division employes 137 people and is subdivided into the Director's office and the technical sections. The Director's office covers the administration, the technical staff for the coordination of the "convenios", the documentation, the budget control group and all auxiliary services.

The technical sections are divided into

- Applied geology section
- General geology section
- Hydrogeology section
- Petrogeology section
- Rock mechanics section
- Mining section.

The following Table shows the distribution of the personnel in the different sections classified by professional background:

Employees classified by professional background

Organisational Unit	Graduates	Skilled	Auxiliary	Administration	Total
Director's Office	7	8	5	32	52
Applied Geology Section	13	10	22	-	45
General Geology Section	4	-	1	-	5
Hydrogeology Section	2	2	-	-	4
Geophysics Section	2	2	-	-	4
Petrogeology Section	6	1	4	-	11
Rock Mechanics Section	4	7	4	-	15
Mining Section	1	-	-	-	1
Total	39	30	36	32	137

Appendix 18 shows the capabilities and specialisation of the graduate personnel, members with post graduate training have not been listed by the division.

4.4.2 Facilities of the Division

Buildings

The division is housed in the buildings of the wood division. A new building will be finished at the end of 1972 or in 1973 respectively. Size and facilities of the new building have been planned generously.

Laboratories

The laboratories in São Paulo are very poorly equipped. For applied geology and rock mechanics there is a well-equipped laboratory in the Ilha Solteira, which is provided by the CESPA and is used also by IPT.

Equipment

The inventory of the laboratories of the different sections is listed in Appendix 19. For the work planned in future, the required equipment is listed in the following Table, classified by sections:

Equipment necessary for the future

Applied Geology

- Motor drill (Anger Power Head), of 10 h.p., diam. 4", for collecting samples of (deformed) soil up to a depth of 10 m; including drilling rods.
- Manual tubes for holes of 1 1/2", up to a depth of 15-20 m, with an engine of 10-12 h.p. Including a diamond core and drilling rods.

Geophysics

- Equipment for use in geolectric measurement of 300 or 500 m ("WIDCO" or a similar make)
- Electro magnetic equipment, as e.g. "TURAM" of "EMGUM"
- Seismic equipment (RS-44 of SIE)
- A gravity meter (type WORDEN)
- A free vertical procession magnetic horizont

Hydrology

- Flowmeter, water-gauge, altimeter, topographic material, Ohm-meter and dry resistance meter for camp use

Mining

- Complete laboratory for geochemical analysis

Rock Mechanics

- Hydraulic bomb PONTENAC, electric type, for 8 hydraulic jacks, 7,000 pounds and reserve capacity of 70 litres
- Radial Rock test (Interfel), for pressures up to 100 kg/cm^2
- Equipment for non-destructive rock tests (MEGAVOLT)
- Transducer for 1000 tons (KIOWA)
- Strain gages (KIOWA or BLH) for measurement of deformations
- Transducer of dislocation (KIOWA)

Petrology

- Special optical equipment, including an apparatus for light reflection for mineral microscopy
- Analytical instruments - special X-ray equipment
- Equipment for preparation of samples, e.g. saws, trituradors and polishers

Rock Technology

- Testing machine for compression, with a cadencio-meter. Max. capacity = 200 t. Scale gradient - 200, 40, 20, 10 tons
- Diamond saw with constand load, with a min. slice thickness of 10" and 20".
- Diamond crown - bab model; cutting 1/2" to 2" diam.
- Drop hammer "Schmidt"
- Rock grinder

Machine shop, stores and maintenance

There is neither a special store nor a machine shop. Maintenance work is carried out by the service firms which supplied the equipment. All equipment has been imported.

Documentation

The division has established a documentation group which is responsible for the technical information of all sections. The recording office and photography is much frequented.

4.4.3 Fields of Activity

The fields of activity comprise more or less the geology sector as a whole, geophysics and engineering geology. The main field of research in this division is the geology of dams. The division is well known and has no competition in Brazil in this field of research. (Appendix 20 shows the fields of activity.)

Projects completed and under way since 1970

These projects have a budget of about 2 mill. Cr$; about 25 percent of this amount is spend for internal research, the remaining 75 percent is contract research work.
A survey of the projects is shown in Appendix 21.

Development planned for the years up to 1975

The main field of research of this division is, as mentioned above, dam geology. Since 1970 this field of activity has been extended considerably owing to the plan of DMGA and has now reached a high standard. According to the plans of DMGA and the budget, the building of dams will continue on the

same scale for the next 5-10 years. All sections of the division are more or less necessary to fulfill these plans. Besides the dam geology it is planned to continue contract research work of any kind in the various fields of geology, but this will depend on the future sponsors.

Future demands of the Government and the industry

The future demands will be in the fields of civil engineering, regional geology and applied geology. The demands for dams geology will decrease in the State of São Paulo after 1974, when the Ilha Solteira dam is finished. However, an increase of prospection and regional mapping is expected.

4.4.4 Comments

In comparison with other research institutes in Europe and Northern America the division of Applied Geology reaches international standards with regard to its working methods and capabilities.

In the future it seems to be necessary to extend the field of activities more and more in the direction of regional geological mapping and prospection of ores and minerals. For special cases the division requires facilities to accomodate temporarily foreign experts.

4.5 Ore Treatment Division

4.5.1 Personnel and Organizational Structure

The Ore Treatment Division has 30 staff members and the following sections

- Administration
- Pilot plant for ore beneficiation
- Laboratory for ore and minerals
- Regional laboratory Apaia

The following Table shows the distribution of the personnel by sections broken down by professional background.

Employees broken down by professional background

Organisational Unit	Graduates	Skilled	Auxiliary	Administration	Total
Administration	2	1	-	5	8
Pilot plant for ore benefication	4	2	2	-	8
Laboratory for ore and minerals	1	3	2	-	6
Apaia laboratory	-	1	6	1	8
Total	7	7	10	6	30

Appendix 22 shows the capabilities and specialization of the graduate personnel; members with post graduate training have not been listed by the division.

4.5.2 Facilities of the Division

The buildings are too small; there is no space and the area is insufficient.
The laboratories are too small and not properly equipped. The actual equipment is partly obsolete and unsuitable for the necessary research and test work. The division does not own a store or magazine. The maintenance is fair.

The offices of the division are highly overcrowded; there are bottlenecks of administration and documentation. The equipment is insufficient. Appendix 23 shows the inventory list of the division. In the near future the division will need a complete laboratory to carry out flotation tests, the installation of a pilot plant for electrolysis and the installation of a spectrophotometer and a spectrograph.

4.5.3 Fields of Activity

Regional Laboratory in Apaia

This laboratory is not active at the moment.

Laboratory of ore and minerals

The laboratory's activities include:
Investigation of the quality of coal tar in the working plant of COSIPA
Analysis of noble metals in metallic copper.
Direct analysis of coal coke and bituminous shales.
Production of iron-sponge with bituminous shale as reducting agent.
Studies on the reduction of pellets and sintered iron ore.
Appendix 24 shows a list of projects completed and under way since Jan. 1, 1970.

Planned Development until 1975

Until 1975 it is planned to install a laboratory for mineral analysis in Apaia.
A pilot plant for the reduction of finely granulated iron ore for producing iron sponge with bitumenous shales as reduction agent will be installed.
The installation of a pilot plant for producing metallic copper by the "Segregacao" process (smelting in oil furnaces and electrolytic refining) is planned.

Future Demand by Industry and Government

Government and private industry, especially foreign investors, are now starting to explore and exhaust the natural mineral resources. This means a high future demand for research work in the following fields:

- Ore and mineral beneficiation
- Ore and iron smelting
- Refining of smelted products
- New technologies for subsequent treatment of iron and metal
- Better technologies for coking processes

4.5.4 Comments for further measures

The division carried out projects mainly in the field of coke processing, sintering, and agglomeration of different materials. Industry and government require in future an intensification of the work in various fields of research. The division staff of only 7 graduates and 7 skilled persons is insufficient to fulfil only a part of the tasks required in future.

For this reason the division should establish a long-term plan for the future work setting some priorities. Several young engineers and technicians should be trained for these fields of activity together with the mining and steel industry in Brazil or abroad.

The importance of iron ore mining beneficiation and steel smelting for Brazil is discussed in section 4.2.4. A cooperation with the metallurgy division may be necessary.

4.6 Wood Division

4.6.1 Personnel and Organizational Structure

The Wood Division employes 63 people and is organized into the Director's Office which is subdivided into

- Information
- Office
- Drafting
- Computer shop
- Maintenance

and the technical groups

- Forest inventory
- Wood anatomy
- Wood utilization
- Wood chemistry

The Forest Inventory Group comprises the following sections:

- Photogrammetry and photointerpretation
- The economics and statistics section

The wood anatomy group includes the anatomy, identification and microstructure sections.

The wood utilization group is subdivided into:

Physical and mechanical properties

Drying

Preservation

Preservatives
Preservation processes
Micology
Entomology

Plywood
Wood finishing
Packaging
Sawmilling

The Wood Chemistry Group contains the

Pulp and paper section with
- Pulp
- Paper
- Conversion
- Graphic arts subsections

The Wood Extractives section deals with

Extractives in general
Utilization of residues
Lignin

The following Table shows the personnel of the division classified by professional background:

Graduated	20
Full skilled	13
Auxiliary	25
Administrative	5
Total	63

Appendix 24 shows capabilities and specialization of the graduate personnel.

4.6.2 Facilities of the Division

The physical facilities of this division are different for the individual groups of this division.

Buildings

The Inventory Group has adequate space, the buildings are sufficient for the actual tasks.

The Wood Utilization Group needs more room for the expansion of laboratories and pilot plants. The buildings of the Wood Chemistry Group are too small and should be enlarged.

Laboratories and Equipment

The laboratories of the Inventory Group are well-equipped and sufficient. The other two groups need larger laboratories, with more up-to-date equipment. A list of the present divisional equipment is added in Appendix 25.

Administration

The administration of the division is generally satisfactory and should be improved in some details only.

Maintenance

There are no complaints about the maintenance in this Division.

Documentation

Opinions about the documentation differ. The documentation of the Inventory Group is kept regularly. The other groups and sections are satisfied with this documentation.

4.6.3 Fields of Activity

The fields of activity of this division are listed in the following Table:

Forest Inventory Group

- Forest Inventories
- Economics Surveys
- Statistical data analyses
- Forest mensuration (natural and artificial)

Wood Anatomy Group

- Anatomy and Wood identification Laboratory
- Anatomical Studies of Brazilian Commercial Woods
- Measurements of fibers and tracheids
- Organization of pattern wood collection
- Biological Essay Laboratory
  (Evaluates the resistance of wood and wood products to biological deterioration, analyses preserved wood and wood preservatives)
- Timber Mechanics Laboratory
  (Performs testing of wood to determine it; mechanical and physical properties)
- Microstructure Laboratory
- Studies on different Layers of fibers
- Origin of wood tissues
- Wood Quality Section
- Measurement of fibrilary angle
- Studies on reaction wood
- Early and late wood proportion
- Pilot plants for wood utilization (perform experimental processing of wood in preservation, drying, sawing and veneer peeling)

Wood Chemistry Group

- Chemical Analysis of wood and other cellulosic materials
- Beating of pulps
- Forming of handsheets
- Quality control of pulp, papers and boards
- Technical assistance to the pulp, paper and board industry
- Training of manpower for the pulp and paper industry
- Pulping of wood and other cellulosic materials by chemical and semichemical processes
- Identification and characterization of pulps
- Physical and mechanical testing of pulp, papers and boards
- Development of processes in the field of pulp and paper

Graphic Arts

- Testing of printing papers
- Development of processes in the field of graphic arts
- Technical Assistance to the graphic Industry
- Training of manpower for the pulp and paper industry

Extractive Laboratory

- Rosin and turpentine pilot plant - Operation and Maintenance
- Analysis of Rosin and Turpentine
- Research and identification about natural extracties
- Toxidity of extractives from national woods
- Extractions and Instrumental Analysis
- Research about extraction of pitch from Pinas
- Tannant substances

According to information given by the director of this Division there has been a lack of demand for the work of the Wood Division by the industry and government in the past. However, this has changed as becomes evident from the contracts and "convenios" signed. Appendix 27 shows the projects completed and under way since January 1, 1970.

Development planned until 1975

Until 1975 it is planned to extend the economic survey of the wood primary transformation plants to the Southern States. An integrated plant for wood processing will be erected, which will include an experimental sawmill, dry plywood and particle board plant.

Other activities will comprise:

- Setting up of a quality control plan for the various wood product industries, mainly for the plywood and wood processing industry
- Development and standardization of analysis for rosin, turpentine and natural extractions
- Fractionation and identification of rosin and turpentine components
- Research on rosin from pine woods
- Utilisation of residual lignin from pulpmills
- Research on volatile extractions
- Natural gums and rosins
- Fungicide, alcoholic and dyes
- Fundamental research on lignin

- Sheet destillation for extraction of oil and wood, hydrolysis for microbiological production of alcohol and yeasts.

Estimation of future research demands by the Government and the Private Industry

In 1970 the Brazilian per capita paper consumption amounted to 13.5 kg which is about 5 percent of the consumption in the United States. It is estimated that the pulp and paper consumption will double until 1975. Industry and government will require research to reach this level because the actual technology is not sufficient to support the development planned.

In Brazil the industry of wood extractions is in its initial stage of development. It is estimated that the pine forests now being planted will yield approximately 60,000 tons of rosin in 1980.

Private and government organizationswill increasingly demand technical support, particularly with regard to the processing of the raw material supplied by the forests now being planted under fiscal incentive.

4.6.4 Comments for Further Measures

The organization of the Wood Division is not very transparent for an outsider. The differentiation of the sections seems to be rather vague. It should be noted that in the "Wood Inventory" section there is only one qualified staff member. This lack of personnel does not permit intensive work.

This section needs economic experts collecting basic data on the type, qualities and quantities of wood required and the qualities and quantities available.

A statistics and information center is to be erected on the exploitation and consumption of wood.

So far, the inventory section was working mostly on a small scale, mainly for special works of exploitation.

For the development of the wood industry in Brazil regional large-scale inventory planning is necessary. For this reason, the Wood Division has to train experts especially in wood economics.

The equipment of the division is poor and obsolete. The division does not have close relations to the industry. We recommend to send two experts, a wood economist and a wood chemist to prepare together with the staff of the division a useful organisation plan, to train people and to set up short-term, medium-term and long-term plans for the different sections of the division.

4.7 Chemistry Division

4.7.1 Personnel and Organisational Structure

The Chemistry Division employes 111 people. The Division is organized in administration and technical section.

The administration section covers Director and his staff, division bureau, stores and auxiliary services.

The technical section is subdivided in five groups, each one covers different laboratories as follows:

- Inorganic analyse group
  - Laboratory of ore analyses
  - Laboratory for analysis of industrial products
  - Laboratory for analysis of metallurgical products
- Organic analyse group
  - Laboratory of organic analyses
  - Laboratory of petroleum durates
  - Laboratory of oils and fats
- Instrumental analyse group
  - Laboratory of Physical-chemical research
  - Laboratory of Espectografies
  - Laboratory of Padroes
- Technical inorganic group
  - Laboratory of ceramics
  - Laboratory of non-metallic minerals
  - Laboratory of industrial process development
- Technical organic group
  - Laboratory of rubber and plastics
  - Laboratory of tests for industrial products
  - Laboratory of paints and laquer

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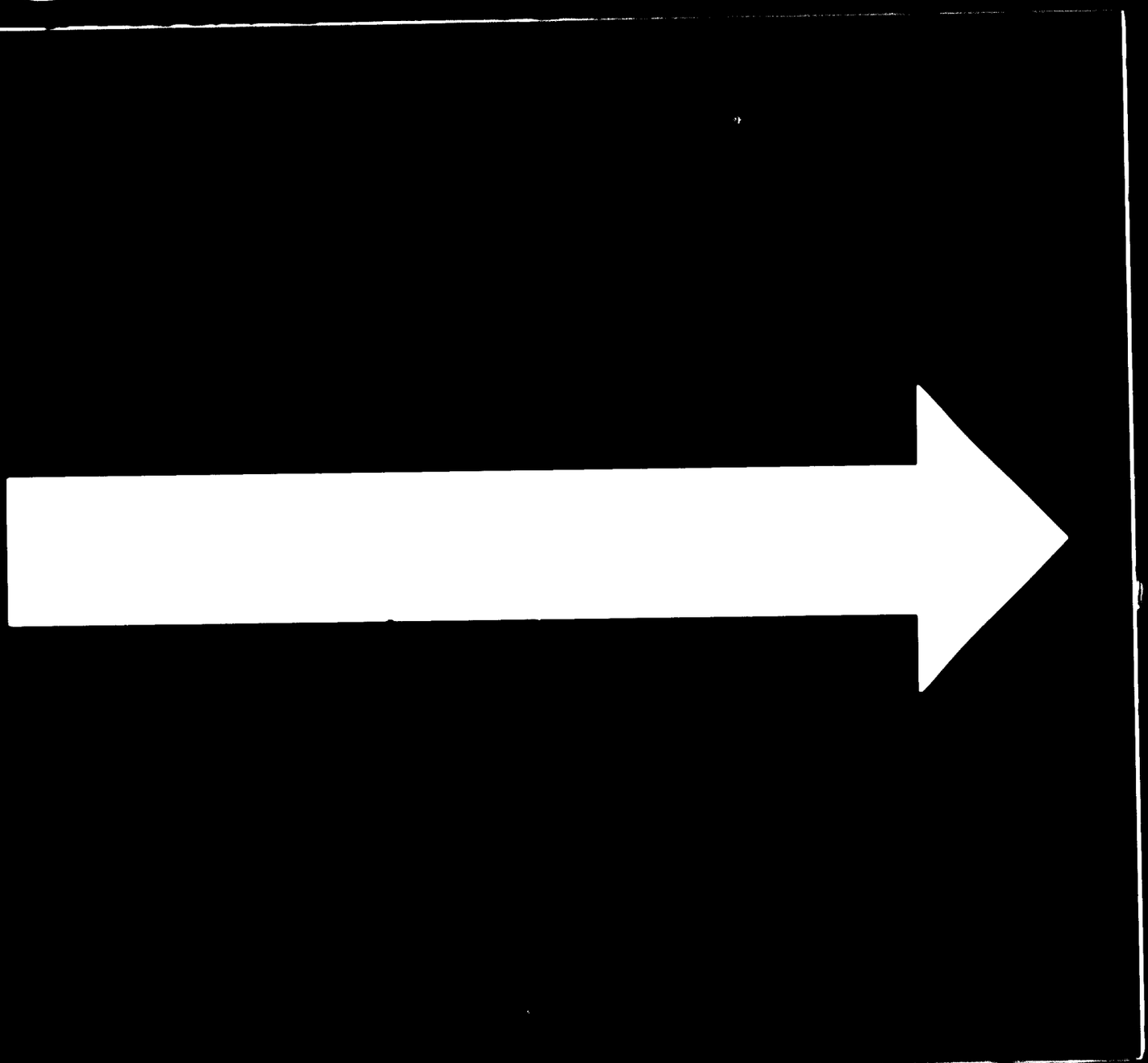

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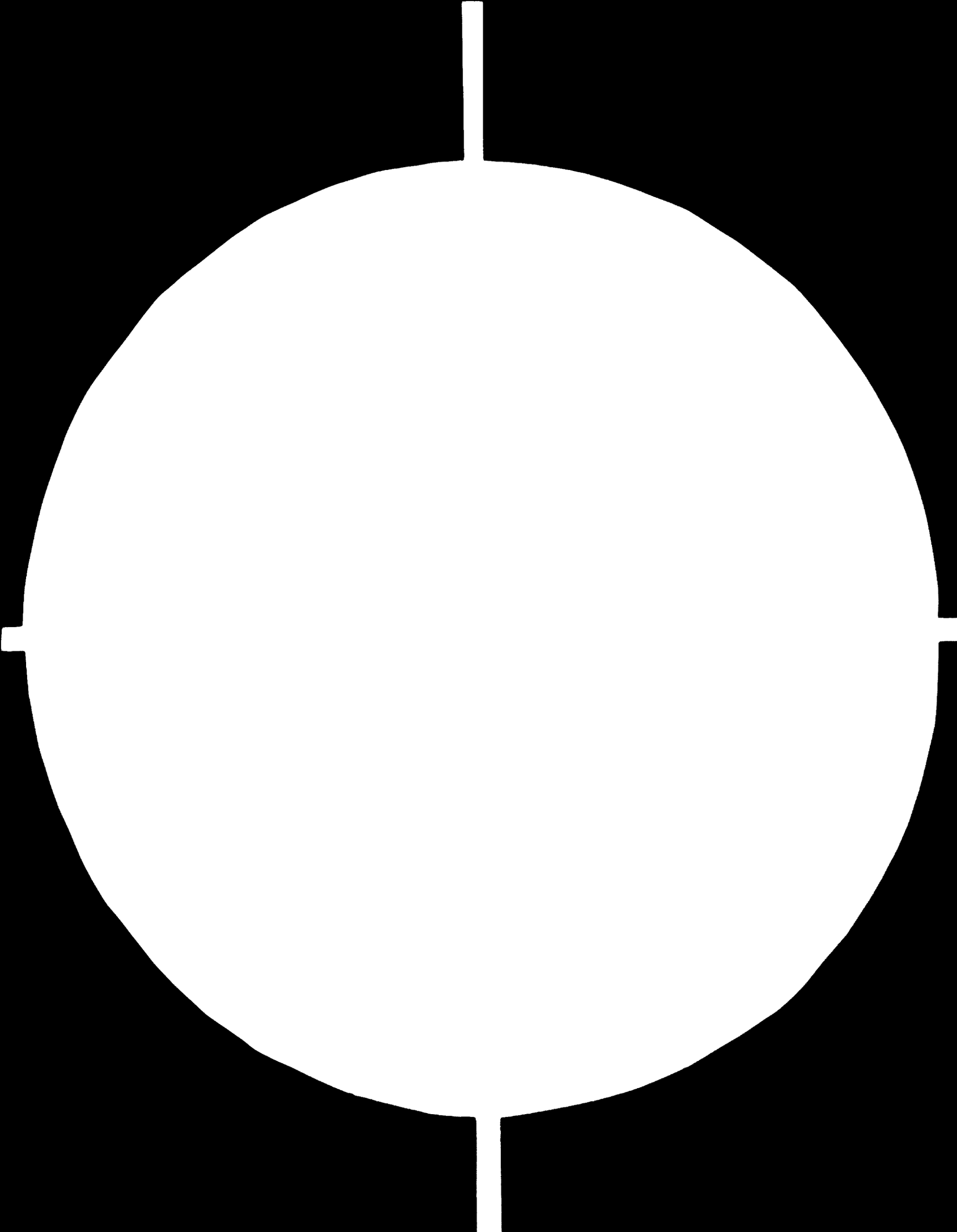

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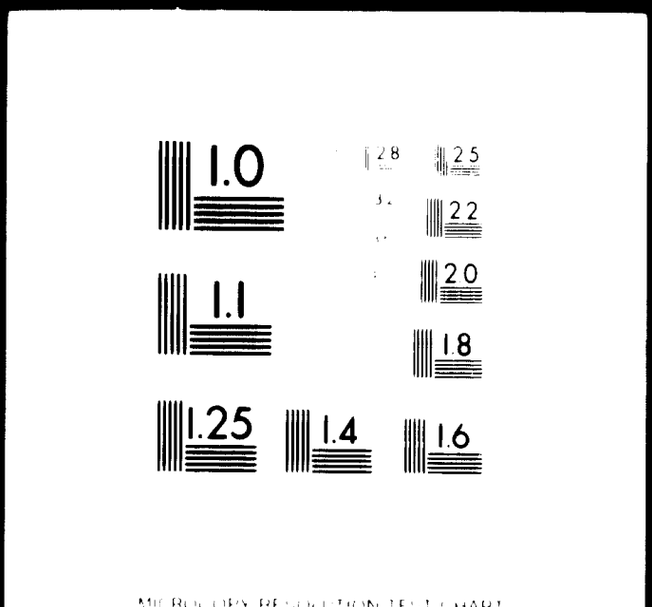

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The following Table shows the distribution of the personnel in some groups of this division broken down by professional background. The other groups did not answer this question in the questionnaire and in additional interviews.

Employees broken down by professional background

Organisational Unit	Graduates	Skilled	Auxiliary	Administration	Total
Administration	..	..	..	..	..
Inorganic Analyse Group	8	11	10	-	29
Organic Analyse Group	6	no answer	no answer	no answer	
Instrumental Analyse Group	5	no answer	no answer	no answer	
Technical Inorganic Group	no answer	no answer	no answer	no answer	
Technical Organic Group	7	3	6	-	16

Appendix 28 shows the graduated emploees of this division and their capacity and specialisation, it was not possible to find out if this is complete or not.

4.7.2 Facilities of the Division

Buildings

The buildings at the disposal of this division have about 6,500 m^2. That is sufficient for the moment and for future tasks too.

Administration

The administration is well organised

Documentation

The documentation could be better; more information of the various technologies would be desirable.

Laboratories

The laboratories are mostly spacious and well equipped for actual tasks.

The installation of semi industrial pilot plants for various chemical processes would be necessary in the future.

Appendix 28 shows the equipment of the division; the following table shows the equipment which is necessary for the future:

Necessary Equipment

Mass spectrometer
Nuclear magnetic ressonance apparatus
X-ray electron microprove analyzer
Recording emission spectrometer
X-ray diffractometer
X-ray spectrometer
Differential thermal analysis apparatus
Electron spin ressonance apparatus
Gas chromatograph
Infrared spectrophotometer
Ultra-violet spectrophotometer
Atomic absorption spectrophotometer
CHN analyser
Liquid chromatograph
Particle size analyser
Flame photometer
Polarographic analyser
Molecular weight determination apparatus
Fluorescence spectrophotometer
Spectropolarimeter ORD-CD
1 Gurley Type Stiffness Tester Shimadzu
1 Crease Recovery Tester Shimadzu
1 Dinamômetro Auromático Uster
1 Dispositive Adicional para o Danamôme-ro (Automatic Multiple Bobbin Attchment) Jster
1 Diagrama de Febras Uster
1 Varímetro Uster
1 Alimentador para o Varímetro Uster
1 Instalação Eletrônica "Uster-Classimat" Uster
1 Xenotest Hanau
1 Launder-Ometer, mod. LHD EF Atlas Electric Devices Co.
2 Escalas cinza geométrica de alteração de côr AATCC
2 Escalas cinze geométrica de transferência de côr AATCC
1 Torsímetro automático
1 Fibrograph transistorizado Spinlab
1 Thermotest
1 Random-Thumble Pilling Tester, mod. Pt-4 Atlas
1 Aspa Automática com tensão regulável
1 Elmendorf Tearing Tester
1 SPI Flammability Tester Shimadzu
4 Perspiration Tester, mod. PR-1 Atlas Electric Devices Co.

A Secção de Tintas, mesmo para o atendimento de solicitaçaoes externas, necessita de uma série de aparêlhos e facilidades cujo detalhamento seria bastante extenso

Novos misturadores para borracha, um de cilindors e uma fechado (Banbury); Calandra; Injetora e extrusora para plásticos; Reatores para polimerizações e equipamentos auxiliares, tais como viscosímetros, etc.

Espectrofotômetro Vis-UV registrador
Potenciômetro registrador
Aparêlho de destiação para purificação de solventes

4.7.3 Fields of Activity

The Chemistry Division is carrying out all chemical analyses for the other divisions of IPT if necessary.

General activities of group

Inspection of quality registration, inspection of productivity, inspection of continuous operation and number of operators, inspection of tax draw-back for exportation products, students and technician training, related research work, etc.

Organic analysis section

Analysis of essential oils, organic compounds, soluble coffee (coffeine, etc.) resins, etc.

Standard methods

United States Pharmacopeia
Association of Official Agricultural Chemists
EDA Specifications and Standards
American Standards for Testing Materials

Oils and fats section

Analysis of oils and fats (vegetal and animal), soaps, detergents, desinfectants, fungicides, etc.

Standard methods
American Standards for Testing Materials
"Associação Brasileira de Normas Técnicas" standards
American Oil Chemists' Society Standards
Association of Official Analytical Chemists

Petroleum derivates section

Analyses of gasoline, querosene, fuel oils, lubricating oils, Diesel oils, solvents, grease, etc.

Standard methods
American Standards for Testing Materials
"Conselho Nacional de Petróleo" Standards
"Associação Brasileira de Normas Técnicas" Standards

It was not possible to get any information from the division Director about the future demand of the chemical industry in Brazil. Some information was promised but never arrived.

5. External Liaisons

The existing liaisons of the IPT with

- the industry
- the state and federal authorities
- the scientific institutions (universities, other research institutes)

were analysed and criticised to identify possible weakpoints and to elaborate recommendations for necessary improvements.

In view of the comprehensive work to be executed under the project the analysis of the external liaisons had to be concentrated on identifying the main weak points and gaps so as not to exceed the budgetary limitations. However, the actual situation turned out to be not very difficult to realize. Expecially the identification of the main weak points did not need very sophisticated analytical work.

Thus the results of this work, which are summarized on the following pages, may be considered to be realistic and reliable.

5.1 External Liaison Functions and their Position within the Organizational Structure

As usual and necessary in institutions of the kind in question the activities which can be summarized under the heading "External liaisons" are maintained within the IPT by

- the Superintendence itself
- staff units established especially for this purpose
- the research departments

5.2 Efficiency of the Positions Engaged in "External Liaisons"

"External Liaisons" consists of three different functions, which are organized separately:

- Establishment, organization and maintenance of relations with government authorities: this function is assumed by the Supterintendence
- Establishment, organization and maintenance of relations with the industry: this function is under the responsibility of the position "Industrial Relations"
- Establishment, organization and maintenance of relations with other research institutes and universities: this function is under the responsibility of the position "Cultural Relations"

The two last functions belong to the staff of the superintendent, which includes eight positions appropriated in the organization plan (see section 3.5.3).

5.2.1 Industrial Relations

The function of this position is to establish and maintain relations between IPT and all industrial enterprises of Brazil, which might be potential sponsors.

The position exists since August 1969. It is occupied with a qualified metallurgist, who several years ago was working for the Metallurgy Division as scientific staff member, and is working again for IPT since August 1969. He is not only responsible for "Industrial Relations", but also for

- the drafting of "convenios" with the industry
- the supervision of financial execution of convenios
- incoming mail.

His duties are stated in detail in the "Rules for the assessory of the Superintendence".

Operation of the position

There is no regulation so far in what way the holder of the position has to report on his work. Thus, reports are made 'only occasionally, if there is anything worthwhile reporting'.

According to the information supplied by the holder of the position he visits about one to two potential sponsors per week. The discussions are initiated partly by himself, partly by the individual research divisions. In each case he talks with the relevant research division beforehand.

There is no separate budget for staff expenses and equipment. Funds are appropriated only for special projects (e.g. the recent publication of the IPT brochure).

The holder of the position estimates that his working time may be allocated to the individual duties as follows:

- Industrial relations	55 %
- Drafting of "convenios"	20 %
- Supervision of financial execution of convenios	
- Incoming mail	20 %
- Promotional discussions with special government officials (to support the policy of the superintendent as his delegate)	5 %

The different research divisions within th IPT are contacted only irregularly, as the following estimates show:

- Metallurgy division: two to three times a month
- Mechanical Engineering division: twice a month
- Wood division: once to twice a month
- Geology and the other remaining divisions: less than once a month
- Mineral treatment: this division was established about 12 months ago Up to now there has been no contact at all.

Frequently, the research divisions hold discussions with potential sponsors without informing the central staff position "Industrial Relations" There are no rules in what way "Industrial Relations" has to be kept informed

The staff position "Industrial Relations" hopes to be able to improve its activities form March 1972 onwards, because then the results of an inquiry will be available (see questionnaire and covering letter in the Vol. of Doc. No. 4)

Advertising and Public Relations Literature

So far, there is only one brochure in not very attractive lay-out, in which IPT presents itself to interested persons (see Volume of Documents, No 5). This brochure was prepared with the assistance of an advertising consultant and published in 1970 in about 5000 copies. (The last information of this type was published in the early fifties.) The texts were jointly elaborated with the division heads, the lay-out was mainly prepared by the advertising consultant, and the copies were dispatched by the library. The staff position "Industrial Relations" was not consulted.

Nor was "Industrial Relations" consulted for publications of the scientific staff. As far as special reprints are available, they are circulated by the staff members themselves or by the library.

Mailing List

The library has a mailing list (see Vol. of Doc. No. 6) which is used for the dispatch of the reprints. The list contains almost exclusively addresses of university libraries, research institutes, documentation centres and newspaper publishers. However, it is unsuitable for maintaining contacts with the industry. Some divisions use special card indexes, which they assembled by their own.

5.2.2 Cultural Relations

In general the functions of this position cover the development and maintenance of relations between the IPT and the other Brazilian research institutes and universities. Of special importance is the maintenance of the increasing pedagogic and technical connections with the Polytechnical School of São Paulo University.

The position exists since February 1970 and is occupied by a qualified physicist who as former member of São Paulo University (full professorship), the National Research Council of Brazil and the FAPESP (Fundação de Amparo à Pesquisas do Est. do São Paulo) can utilise his personal contacts.

Since 1970 the holder of the position is engaged to an increasing extent in elaborating training courses coordinated with the program of lectures of the Polytechnical School of São Paulo University (see the latest training program in the Annex).

In addition, scholarships fall within the responsibilities of the position. For some years, there are always several staff members of IPT who have scholarships abroad. The scope of this program is shown by the table on the following page.

At present Cultural Relations has no budget, but this has not been a drawback so far for fulfilling the essential functions.

In the opinion of the person holding this position there are two main weak points - as far as the present situation is concerned - in the whole field of external relations:

- There should be a special P.R. function to transfer information from inside IPT to the outside regularly, systematically and - compared to the present situation - to a greater extent.

- A certain shortage of labour capacity to fulfill the duties in his own function effectively.

The person in charge of the function "Cultural Relations" has nobody assisting him. As already mentioned the occupation with the elaboration and coordination of the joint IPT-Polytechnical School-Program of lectures and training courses will make demands upon his time to an increasing extent.

It seems advisable to examine this position as to whether the labour capacity required to fulfill the above duties is in agreement with the presently available staff (one person). On the basis of the above information it may be assumed that this is not so.

SCHOLARSHIPS - OFFICIAL MISSIONS - ATTENDANCE AT CONFERENCES ABROAD 1971

NAME	DIVISION	PLACE	DURATION	GRANTED BY
- SCHOLARSHIPS FOR ACADEMIC DEGREE				
R.L. Plaut	Metallurgy	Sheffield, GB		FAPESP, Brazil
J.C.T. Riva	Mechanics	M.J.T., USA		FAPESP, Brazil
A. Cantizani Filho	Mechanics	Stanford, USA		Min. Planej., Brazil
- SCHOLARSHIPS FOR COURSES AND/OR TRAINING				
J.O. Toral	Metallurgy	Buenos Aires, Argentine	12 months	Gov. of Argentine
A. Bartz	Wood & Forest	Hamburg, Germany	12 months	Gov. of Germany
A.MS. Oliveira	Geology	Paris, France	9 months	Gov. of France
J. Ishida	Metallurgy	Paris, France	12 months	FAPESP, Brazil
S.A. Guedes	Civil Engineering	Paris, France	6 months	FAPESP, Brazil
F.G. Cavaleiro	Civil Engineering	Bogotá, Colombia	4 months	OEA
C.L. Mariotto	Metallurgy	GB and USA	2 months	FAPESP, Brazil
A.R. Zandonadi	Chemistry	Canada and USA	3 months	Canada - Brazil
S. Oniki	Chemistry	Canada and USA	3 months	Canada - Brazil
- OFFICIAL MISSION AND/OR ATTENDACE AT INTERNATIONAL CONFERENCES				
A.P. de Castro (Superintendent)		Copenhagen and Genéve) Bogotá, Colombia)		International Meetings
P.S. Santos	Chemistry	Washington, USA		CNPq - Brazil
A.D.F. Napoles Neto	Civil Engineering	Bogotá, Colombia		OEA
I.L.A.N. Junqueira Filho	CPI	Tel Aviv, Israel		FAPESP, Brazil
T. Morita	Chemistry	Tokyo, Japan		Gov. Japan

5.3 External Relations of the Research Divisions

To determine nature and scope of the external relations of the IPT research divisions, discussions were held with the division heads on the basis of the questionnaires attached in the Annex.

On these occasions, it was requested to comment on the following opportunities of presenting IPT and its work to the public:

- Presentation of papers on congresses, conferences and seminars
- Periodical invitation of potentially interested groups (industries) to visit the institute - perhaps in connection with the presentation of some work
- Brochure representing IPT as a whole
- Special brochures on the individual divisions
- Monthly or quarterly published IPT information periodical

In addition, requests were made to

- state substantial weak points concerning the present external relations
- make suggestions for an improvement of external relations in the future

The discussions showed that the divisions differ only slightly in their individual attitudes and activities in the field of external relations, which might be connected with the fact that the scope of work conducted in the individual divisions is almost identical.

Concerning the groups "private industry" and "public industrial establishments" all divisions are mainly engaged in routine testing. This applies especially to foreign joint ventures, which in general require only very specialised or precision testing. Routine testing represents at the same time the main total work load of each division. IPT is contracted to a lesser extent for technical assistance in the rapid solution of unexpected and urgent problems (trouble shooting). It is approached relatively rarely for pure research work - if so, normally only comparatively unpretentious tasks are delegated to IPT.

The dominant character of work - routine testing - means on the one hand a rather close and permanent relationship to a large number of companies, on the other hand it means contacts on a level different from that, on which the potential sponsorship of large-scale contract research work is to be discussed. At present the group of "government agencies and corporations" is the main source of contracts for execution of genuine research work (in most cases combined with technical assistance).

The relations and connections with private industry, public industrial establishments and foreign joint ventures may be rated as 'fair to excellent' concerning routine testing, 'inadequate to poor' concerning genuine research work, 'poor' concerning genuine large-scale contract research.
The relations and connections with government agencies and corporations may be rated as 'fair to excellent'.

The connections and relations of IPT and its research divisions with professional associations may certainly be rated as 'outstanding': the divisions not only maintain close connections with the leading professional associations in their

specific branches but in some cases they were founded with the help and sometimes on the initiative of IPT, e.g. in the fields of civil engineering and metallurgy.

The necessary connections with libraries are maintained without exception via the IPT library, which applies also to the general utilization of external information and documentation services.

Permanent close connections and firm relations between IPT and the academic community are secured as a consequence of the program of lectures and courses of the Polytechnical School of São Paulo University and in addition by the fact that the university is represented in the advisory board of IPT.

The connections and relations with other institutes working in the same fields have been and are at present chiefly informal and are based mainly on personal contacts of the individual scientists. Thus, the actual intensity of the connections of IPT with other Brazilian institutes on the one hand and with some important research institutes abroad on the other hand seem to reach almost the same level. However, it is to be expected that the present situation will change in the coming years, because both state and federal governments are well aware of the inevitable disadvantages of this situation and are obviously just starting to tackle the specific problem of insufficient coordination to improve the efficiency of the limited (by number of scientists as well as available financial resources) research capacity.

The members of each division publish each year several publications, often papers to be presented on congresses, conferences and seminars. This relates to the fact that these

events are judged as important means for maintaining scientific communication as well as establishing external contacts and presenting the IPT. For some years members of each division attend specific main international and regional conferences.

The attitude towards the invitation of selected groups of potential clients as an instrument for sponsorship development seems to be more or less indifferent. Several divisions seem to have tried this approach on their own without any significant success.

More favorable was the attitude towards a brochure, in which IPT would be presented with all its facilities, experience and capabilities.

Nearly all division heads would appreciate

- special brochures on the individual divisions (not available, planned by two divisions)
- periodical publication (monthly or quarterly) of an IPT information brochure, which existed once, but ceased to be published some years ago - obviously to save costs; in the discussions its lay-out was generally considered to be 'poor'.

In the discussion the division heads were unable both to state substantial weak points and to make definite suggestions for an improvement of the external relations.

5.4 The Present Situation Concerning External Relations in General

The present situation may be summarized as follows:

- Intensity of external relations

  Close relations exist in the science sector. This is expressed by the detailed educational program, with which IPT contributes to the training of students of São Paulo University and whose scope is steadily increased. The conditions are of course particularly favorable because of the Institute's association with the university and the existence of staff relations.

  The relations to other institutes similar to IPT, however, differ in intensity and are in no way organized or institutionalized.

  Close relations exist also with the State Government, which may be attributed both to financial reasons and the legal status of IPT. To a lesser extent this applies also to the Federal Government (this results among others from the membership in the Council for Technological Research).

  The relations with the industry are not very close. Only relatively weak efforts are made so far with regard to systematic and intensive establishing and maintaining of contacts with this important sector.

- Distribution of functions

  The Superintendence, which is mainly engaged in procuring funds and work and is responsible to the Government with regard to the operation of the institute, in particular maintains the contacts with the State and Federal Government.

The capacity of the position "Cultural Relations" is taken up almost completely by the preparation of co-ordinated training programs for São Paulo University.

The holder of the staff position "Industrial Relations" can devote only part of his time to this function. This is the main reason, why at present the intensity of developing and maintaining contacts with the industrial sector has to be rated as inadequate.

The staff members of the research divisions maintain only informal and occasional contacts to similar institutes in the state of São Paulo and other states of Brazil and establish the necessary contacts with the industrial enterprises sponsoring projects. The intensity of effort differs of course to a large extent between the individual divisions. There are no regulations for the establishing, maintaining and organization of such contacts in any of the divisions.

- Operation and technical aids

Personal discussions with acquaintances and professional colleagues are of major importance. Memberships - both personal and those of the institute - in professional associations and organizations as well as participation in conferences are also very important. These opportunities for external relations are seized by IPT satisfactorily. In addition to this "passive" procedure, however, only few efforts have been made so far towards an active and systematic promotion policy.

The weakest point within the efforts of IPT towards external relations is the manner in which the institute itself and the individual research divisions present themselves to the public in writing. There is no publication so far summarizing the capabilities and activities of the individual research divisions. A single brochure has been published recently, in which the institute presents itself as a whole. Lay-out and technical presentation, however, are unsatisfactory. An unpretentious IPT information brochure to be sent regularly to potential and present sponsors of IPT existed once, but ceased to be published some years ago to save costs.

5.5 Recommendations

The present situation in the field "External Relations" is partly unsatisfactory. Therefore we propose the following measures:

- Expanding of capacity:

  The present capacity of 1,6 persons directly available for "External Relations" is not sufficient. It should, therefore, be brought to at least three persons as quickly as possible (auxiliary staff not included).

- Change in distribution of functions:

  The necessary increase in capacity should reasonably be linked with a revision of the present distribution of functions. When assigning the tasks regard should be paid to the individual abilities and interests. For

this reason no detailed draft in respect of the distribution of functions can be given here. However, the following basic break down appears to be appropriate:

-- governmental agencies
-- industrial enterprises
-- São Paulo University Polytechnical School
-- other research institutes

- Organizational integration of functions:

  The functions "Industrial Relations" and "Cultural Relations" which have so far operated independently of each other should merge and form an enlarged organizational unit "External Relations". The present organizational situation may remain unchanged if the performance as a homogeneous group is not impaired.

- Coordination of the "External Relations" - activities of the research departments:

  As is evident the functions performed by the research divisions involve substantial external relations. At present they are operating not only very independently in this respect but also largely isolated. This results in a loss of promotional potential for the whole IPT. It is therefore recommended to oblige the research divisions to consult the "External Liaisons" department in time whenever they intend to come out with scientific contributions by participating actively in or organizing of congresses, conferences or seminars. The same applies when a circle of potential customers is to be contacted or to be provided with scientific information. In doing so it is important to define unequivocally the term 'potential client' for the research divisions.

- Definition of responsibilities and ensuring of mutual information:

  Being an auxiliary function of the Superintendence the "External Relations" department does not require any powers of its own to give instructions. However, it must have an unrestricted right of being informed in respect of all projects and activities in the field of "External Relations". In addition, it must be obliged

  -- to be available for consultation by the research divisions and co-operate with the latter in case the field of "External Relations" is concerned

  -- to consult in time the research departments concerned and proceed only in agreement with these when planning and carrying out its own external activities

- Appropriate reporting:

  In future a short written report should be made on every talk contributing to establishing contacts or obtaining orders. If the report is made by "External Relations" it must be passed on to the Superintendence and the research divisions concerned; if it has been written by members of the research divisions the Superintendence and External Relations must receive the report

- Providing improved papers for information:

  The papers which IPT and the individual divisions are able to present to potential clients do not yet meet the requirements as regards both quantity and quality. It is recommended to provide at least the following documents

-- informative booklet on the whole of IPT (annual revision)

-- a smaller booklet for every research division, at least 4 pages (revision in case of substantial changes)

-- a sufficient quantity of special prints of all suitable treatises and papers of IPT staff members

As a medium-term measure it should be checked whether

-- a periodical of the Institute to be published at regular intervals is to be printed (this could replace the informative booklet on IPT to be published at annual intervals until such time)

-- a series of monographs - possibly in co-operation with a publisher - is to be issued.

It is important that all papers published should not be inferior to those of large enterprises as regards lay-out, quality of paper and print.

- Systematic identification of potential clients:

It is recommended to continue on a larger scale the efforts just started to identify potential clients. It is necessary to define clearly the IPT markets for the research possibilities offered by IPT at present and in future, to determine their quantitative potential and to identify the potential clients in these markets.

This task of investigating the market potential should be taken care off by the "External Relations" department in co-operation with the research divisions and, if necessary, by engaging external specialists. The results of the investigations provide the necessary basis for a siystematic marketing activity.

- Co-ordinated marketing activity:

  Establishing and maintaining contacts should be done as part of a program outlining the course of action to be pursued. This program is to be elaborated jointly by the "External Relations" and the research divisions. It provides which tasks have to be performed and by whom and whether establishing and maintaining of contacts with the various groups of potential customers is to be done by

  -- arrangement of personal talks

  -- forwarding informative papers on IPT and/or essays, treatises, books published by IPT-staff members

  -- invitations to attend IPT-organized meetings.

  Attendance at or organization of congresses as well as publication of scientific essays in the pertinent periodicals should be included in the plans to the extent possible.

  The adresses of actual and potential clients should be entered in a centralized card index to be kept by the department "External Relations".

- Establishing an annual financial budget:

  It is recommended to provide the "External Relations" department with an annual budget. The essential criteria for the size of the budget are the turnover planned and the "External Relations" program outlining the appropriate course of action to reach the turn-over.

It has to be considered, that these suggestions for an improvement of organization, information and operation can only provide the formal conditions, which permit an efficient working. The actual results depend from ability, energy and ambition of the persons, responsible for the activities in the field "External Relations".

6. Measures Recommended

Internal Organizational Set-up

- State Contributions should be replaced by research contracts as soon as the requirements for such a procedure concerning the State are ensured. However, the obligation of the State to finance basic activities of the Institute must not be jeopardized.

- In view of the positive development of the Brazilian industry it would be sound policy of IPT to finance an increasing proportion of its activities by revenue from research conducted for the industry. To strengthen IPT's growth potential subsidies or contract revenue from the State should not be curtailed to the same extent.

- The conversion of IPT into a foundation with a sound financial basis should be planned for the future; this should, however, not be regarded as an urgent aim in the short run.

- Uniform methods of pricing on the basis of real costs should be used by all divisions. Deviations from the principle of pricing according to total costs should only be permitted if they are in agreement with precise regulations from the Superintendent, and the divisions should be obliged to slate the reasons for any deviation on the precalculation sheets.

- Cost accounting, precalculation and monthly calculation of project costs, as a basis for price policy and to promote efficiency, should be introduced as soon as possible.

- To improve project evaluation and utilisation of research results IPT's staff should be supplemented by several highly qualified members with techno-economic background; staff members should be trained in systems analysis and cost-benefit analysis

- Complete problem definition of projects should be better ensured and facilitated by forms and checklists to be answered and filled out by the divisions for every project proposed, which consider all non-technical aspects relevant to the problem (economic, social, marketing, transfer aspects, etc.)

- On the basis of checklists the completed research project should be followed-up systematically to examine difficulties in the transfer of the results, to promote the transfer and to utilise experience so as to avoid the same mistakes in project definition being made in future.

- To strengthen the interdisciplinary approach in IPT's activities and to make technical research hereby more effective the planning and execution of complex projects with strong technical aspects - such as implementation studies for capital or consumer goods industries, elaboration of industrialization plans, industrial estate planning, regional or urban planning, export promotion, educational planning in technical fields, etc. - should be aimed at, in the beginning preferably in joint cooperation with a foreign institution experienced in such studies. "Training on the job" by such a cooperation may well prove to be a superior way of transfer of techno-economic know-how to Brazil.

Recommendations to UNIDO

- For the improvement of the internal organizational set-up the assistance of UNIDO is not very urgent; IPT is, in our opinion, able to carry out the proposed improvements on its own. If, however, IPT requests assistance for the introduction of a uniform system of cost-accounting and project-calculation an expert might be delegated by UNIDO for 3 to 5 months, to carry out all necessary work.

- People with a combined training in both technology and economy are difficult to get for IPT, as there exists so far no such discipline in the Brazilian universities. The necessary strengthening of the interdisciplinary approach in IPT's central staff (and, following it, in all technical divisions) might prove to be very difficult for IPT. For this reason, it might be recommendable for UNIDO to send a qualified expert on staff organization to IPT whose job assignment might involve several or all of the following subjects:

  - project definition: proposals and suggestions about the scope of research activities according to requirements of the country as a whole and/or to those of the industry, in line with the long-term development plans of the Government

  - critical evaluation of research projects discussed between sponsor and the Institute's technical departments, under economic implications; this should prevent overrating of the technical aspects and neglecting of economic aspects

- assessment of competing proposals or suggestions on the basis of cost-benefit analyses from the point of view of the country as a whole or a specific branch of the industry

- assessment of the feasibility of a technical innovation under economical aspects; for instance, selecting the best technology of various alternatives, on the basis of cost calculations or a cost-benefit analysis

- industrial market research, in case no information necessary for selecting the best solution among various alternatives is available; or if market research is not included in the Institute's field of activities, initiating a contract for market study by an institution qualified for such a task

- taking care that marketing of technological innovations produced by the Institute is not neglected; giving assistance to the research divisions in the important field of technological transfer

Of course, all these activities should involve intensive training of IPT staff members. In addition to or instead of this procedure, UNIDO might promote cooperation of IPT with a foreign institute for developing and carrying out complex research studies.

Training of IPT's personnel by delegating qualified members temporarily to international or other organizations would be another efficient means to help IPT effectively.

Information Center

The establishment of the planned Information Center is strongly recommended. Technical documentation, computer science and computer application and systems analysis are all important activities for both the economic development of Brazil and for a sound development of IPT.

However, the establishment of a computer-based documentation should not be rushed. Priority should be given to other modern documentation systems (microfilms, etc.), with the emphasis on research in compatibility of such systems with later computerization.

A highly modern computer should be preferred to an older type, even if it would be one of inferior capacity and/or higher cost.

It is recommended that UNIDO should support the planned information center by delegation of an expert in documentation, computer science and/or systems analysis for a period of two years if such one is available. However, ample practical experience is required; a strong sense for pragmatic and economic thinking would be more important than scientific and purely technical competence.

Research Activities

For her industrial development Brazil needs a technical and technological research capacity of her own which should be up to international standards.

No doubt IPT may be very instrumental in promoting the necessary development and improvement of Brazilian research in the future.

It is not thought advisable for the next future, that IPT further diversifies its activities by establishing additional divisions (for instance a textile division) aimed to tackle fields of research basically not yet covered.

Instead, it is recommended to concentrate the research work of IPT on clearly defined fields of research and to establish clear-cut priorities. It may be expected that such a measure would improve the present efficiency. Definition of fields of special importance and establishment of priorities should be linked with the elaboration of long-term development programs for the individual divisions.

In our opinion external support is necessary for that purpose. It is therefore recommended that UNIDO provides IPT the assistance of technical UNIDO experts for implementing these works. We propose such assistance at least for the following divisions:

- Wood Division
- Civil Engineering Division
- Mechanical Engineering Division

External Relations

In order to improve the intensity and efficiency of external relations activities the following measures are to be proposed:

- expanding of capacity
- change in distribution of functions
- organizational integration of functions,
- coordination of the 'External Relations'-activities of the research departments
- definition of responsibilities and ensuring of mutual information
- appropiate reporting
- providing improved papers for information
- systematic identification of potential clients
- establishing co-ordinated marketing activity
- annual financial budget for execution of the external relations-program

Concerning 'External Relations' it seems not necessary for UNIDO to provide additional help.

Project Execution

A final recommendation to UNIDO concerns the execution of projects such as the one in question, which is characterized by the fact that the institution to be evaluated has a highly qualified personnel. The efficiency in the execution of this project could have been improved

- if the mission would have been announced to IPT at least one or two months in advance, so that IPT could have made the necessary preparations,

- if the consultant could have prepared the mission before hand, at home by elaborating questionnaires for the analysis based on sufficient secondary information

- if these questionnaires could have been sent to IPT at least one month in advance or if one member of the mission would have arrived at least two weeks before the other team-members to collect the necessary basic data.

Thus, more time would have been available for defining problems and concentrating on the decisive issues.

Special experience gained by the members of such a mission would permit much more efficient work when being applied to similar problems in other countries.

A N N E X

Development of Number and Quality of Staff 1967-1971

	1967			1968			1969			1970			1971		
	Prof.	Non Prof.	Adm.	Prof.	Non Prof.	Adm.	Prof.	Non Prof.	Adm.	Prof.	Non Prof.	Adm.	Prof.	Non Prof.	Adm.
Administration	2	–	185	3	–	214	6	–	224	13	–	192	17	–	224
Civil Engineering	24	52	20	23	58	28	34	82	30	26	76	18	33	95	31
Mechanics	14	25	5	17	29	8	26	35	14	26	33	15	29	29	18
Metallurgy	11	51	12	17	54	13	24	65	11	31	80	14	27	75	14
Chemistry	24	35	13	27	47	12	29	50	16	37	50	16	31	49	29
Wood	10	16	6	11	20	7	16	22	13	16	35	9	20	33	8
Mines and Geology*)	–	–	–	–	–	–	–	–	–	14	17	9	26	23	26
Ore Processing**)	–	–	–	–	–	–	–	–	–	–	–	–	7	13	4
Convenios	5	25	2	10	14	–	13	26	–	14	39	15	23	41	17
Total	90	204	243	108	222	282	148	280	308	177	330	288	213	358	371

*) included in Civil Engineering)
**) included in Metallurgy) they were separated only in 1970.

Appendix 2

Distribution of Staff Personnel by Employment Period, 1971 (Professional Staff)

Division	Employment Period at IPT (in years)									
	up to 2	2–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40	Total
Administration	5	3	–	2	1	–	1	–	–	12
Civil Engineering	10	11	4	2	1	–	3	–	–	31
Mechanical	8	11	2	3	1	1	1	–	–	27
Metallurgy	5	13	8	–	–	–	–	1	–	27
Chemistry	3	20	6	2	1	2	1	3	1	39
Wood	4	9	4	1	–	1	1	–	–	20
Mines and Geology	8	14	3	–	–	–	–	–	–	25
Ore Processing	2	3	1	–	–	1	–	–	–	7
Agreements	20	3	–	–	–	–	–	–	–	23
Total	65	87	28	10	4	5	7	4	1	211

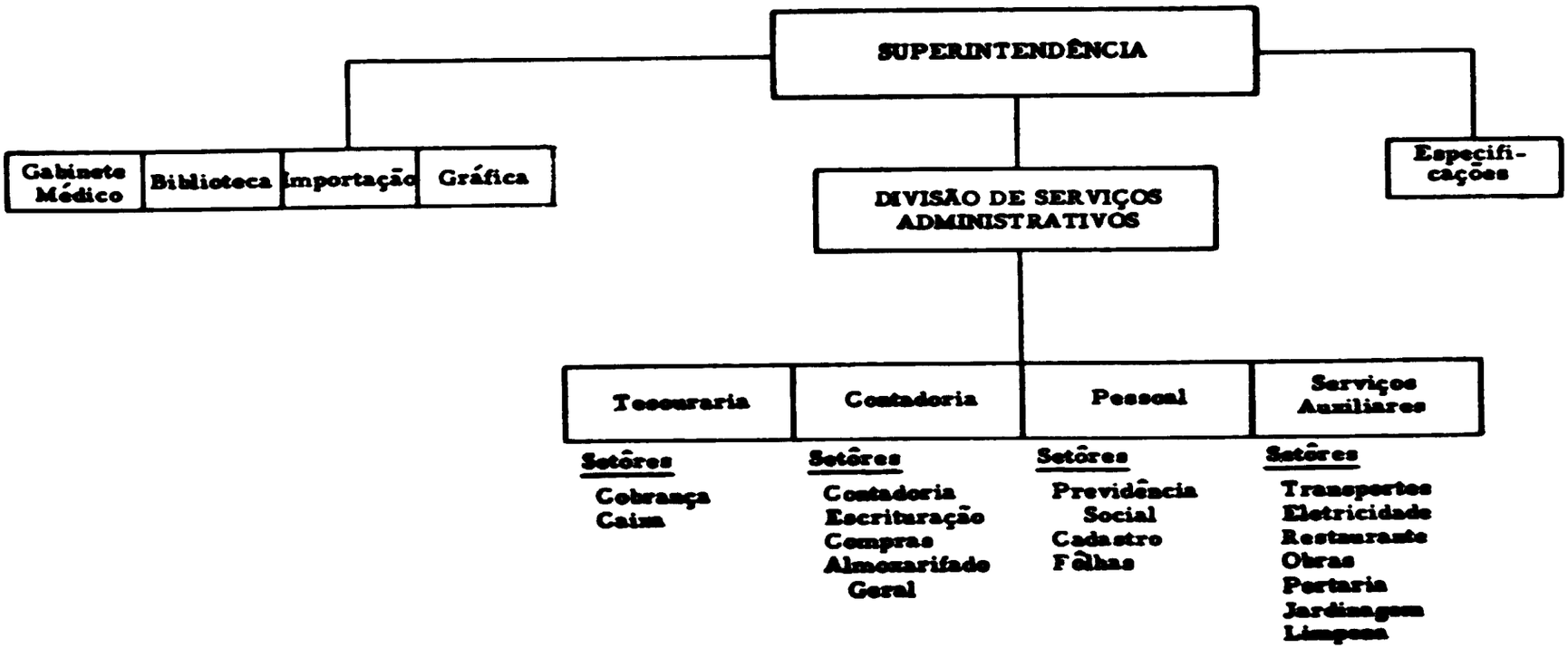
Appendix 3

Distribution of Staff Personnel by Age, 1971 (Professional Staff)

Division	Age									
	23-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-66	Total
Administration	1	4	1	1	1	-	2	1	1	12
Civil Engineering	2	12	9	4	-	1	3	-	-	31
Mechanical	1	14	4	3	2	1	2	-	-	27
Metallurgy	-	11	10	4	-	1	-	1	-	27
Chemistry	2	13	8	7	1	3	2	2	1	39
Wood	2	9	5	-	-	-	2	-	2	20
Mines and Geology	3	13	8	1	-	-	-	-	-	25
Ore Processing	-	4	-	-	-	-	3	-	-	7
Agreements	5	12	4	1	-	1	-	-	-	23
Total	16	92	49	21	4	7	14	4	4	211

I P T

ORGANOGRAMA DA DIVISÃO DE SERVIÇOS ADMINISTRATIVOS



RULES FOR THE ASSESORY OF THE SUPERINTENDENCE*)

Assessory and techno-cultural support

(ref. Art^{o} 21 do Decreto n^{o} 52.644
de 3-2-1971 - Regulamento do IPT)

Art. A1 - The assessory of the Superintendence will include the assistants of the Superintendence and their immediate aids, each of them assuming the functions attributed to them by the Superintendence.

Art. A2 - The functions of the Superintendence assessory are:

I - To exercise the executive direction of certain activities, permanent or temporary, through specific delegation of the Superintendence assisted by the Advisory Council as the case may be.

II - Exercise by delegation of the Superintendence, a supervision of the Complementary Technical Unities and of general administration and of interdivisional groups.

III - Coordinate through indication of the Superintendent - next to the technical division - those functions which even exercised in a decentralized way could advantageously follow uniform proceedings, programs or norms.

IV - Long term planning of human resources of IPT.

V - Coordinate the plans for training of the upper staff of IPT.

VI - Plan and coordinate the participation of IPT at congresses and technical symposiums, in the country and abroad.

VII - Plan and coordinate the relationships of IPT with the University of São Paulo (USP) in its various aspects including the cooperation in post graduation courses.

VIII - Coordinate the conventions with the unities of University of São Paulo and especially the convention with Escola Politécnica da Universidade de São Paulo (EPUSP).

IX - Coordinate the relationship of IPT with other universities and colleges of the scientific and tecnological teaching system of the state and country.

X - Plan andcoordinate the realisation of speciality and extension courses of IPT.

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*) Translation by IPT

XI - Take care of IPT's relations with other research entities and entities supporting research, specially FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo - Support Foundation for Research from São Paulo State) and CNPq (Conselho Nacional de Pesquisas - National Council for Researches).

XII - Take care of IPT's relations with foreign and international teaching entities, research, and support of technological research.

XIII - Follow systematically the relationship of IPT with entities and industries customers of IPT, coordinating the application of measures to improve and stimulate the development of these relations.

XIV - Maintain IPT's image in managerial circles.

XV - Assessoring the technical divisions in their external relationships.

XVI - Coordinate the contacts of IPT with class associations, professional associations and managerial entities.

XVII - Follow the conventions of IPT proposing improvements of the texts of conventions and service contracts.

XVIII - Establish general norms for the services of technical assistence handling also the establishment of unitary prices and contractual modalities.

XIX - Supervise accounting, cadastre, collecting and treasury refering to customers.

XX - Follow the realisation of IPT's receipts.

XXI - Coordinate organisation plans and methods and their implantation.

XXII - Supervise and promote the actualisation of a service manual of IPT, identifying, describing and specifying functions.

XXIII - Coordinate the group of salarial administration and supervise research of the labour market as foreseen by the Complementary Law nº 7.

XXIV - Study and define criterions for the situation of salaries of IPT in the national and international context.

XXV - Coordinate the execution of IPT's expansion projects.

XXVI - Organize and permanently improve a system for the elaboration of service proposals to be executed by IPT.

XXVII - Organize financial planning and keep financial chronogram up to date.

XXVIII - Collaborate in preparing IPT's budget.

XXIX - Accompany the development of IPT's activities, maintaining the record of researches in course of execution and of ideas for new research.

XXX - Organize and manage a permanent group for technoeconomical evaluation of all IPT projects and study and define criterions of merit for IPT's activities and performance.

XXXI - Coordinate the plan and the system of documentation, information and internal and external communication of IPT.

XXXII - Coordinate the planning and implantation of pioneer activities.

XXXIII - Study improvements of the structure and institutional system of IPT.

XXXIV - Coordinate the consideration of IPT in problem cases of ample pluridisciplinal involvement, supervising and mobilizing the necessary human resources.

XXXV - Plan good use of area and installation of IPT, coordinate the projects of amplification and new buildings.

Art. A3 - In order to perform its functions the assessory of Superintendence may dispose of its own staff of employees including high level technical assistants.

Art. A4 - Every assistant of the Superintendence may request to help him in the exercise of his functions classified functionaries from divisions or the administration with the consent of the respective directors who will be elements of contact in the respective area.

Art. A5 - In the exercise of their functions; the assistants of the Superintendence may constitute permanent commissions with classified functionaries of the divisions indicated by the respective director and accepted by the assistants who will function as elements of contact with the respective divisions.

Art. A6 - The matters of the above mentioned divisions related to the area of direction and coordination of an assistant of Superintendence and which have to be appreciated by the technical administrative "Junta" or by the Advisory Council, can be appreciated by these collegiated organs only after having been conveniently informed by the respective assistant of Superintendence.

A Cost-Accounting System for IPT

Contents:
a) Calculation sheet with comments
b) Chart showing the system as a whole
c) Monthly accounts of project costs and cost centers
d) Organisational requirements for the introduction of cost accounting
e) Rate of sophistication

The cost accounting system of a research institute does not differ essentially from that of an industrial firm with job production.

The system is based on the principle of distributing all current costs of the institute - including depreciation on investment - to the current projects.

The costs of every project comprise

- direct project costs (including charges for staff members directly participating in the project, material costs, travel expenses, charges for use of machinery and equipment, charges for technical services, etc., as far as they can be directly assigned to the project)

- a proportionate share of undistributed expenses covering those costs whose direct assignment is impossible or uneconomical.

a) Calculation sheet

The calculation for a project would be as follows:

(1) Staff expenses
(2) + % Overhead of the research department on (1)
(3) Subtotal (1) + (2)
(4) + % General overhead of the Institute on (3)
(5) + Material costs of various kind
(6) + Costs of various internal services
(7) Subtotal (4) to (6)
(8) + % Surcharge on (7)
(9) Total (3) + (7) + (8)

Comments:

ad (1) Staff expenses

They are charged to the various projects (or, if concerning activities not chargeable to special projects, to an overhead account or cost center) by means of timesheets (on a weekly or monthly basis). The total number of working hours spent on a special project or account is multiplied by an hourly rate of pay, which may be calculated separately for every staff member or may be an average rate for staff members of comparable qualifications.

The hourly rate can be calculated as follows:

(I) Annual staff expenses

Annual gross pay (including special gratifications)

+ Annual social contributions (including taxes based on salaries)

+ Annual fringe benefits (including e.g. contributions to the canteen for lunch)

= Total annual staff expenses

==========

(II) Annual working hours

Annual gross working hours

./. Hours of vacation

./. Hours for special short leave (average per staff member)

./. Sickness hours (average per staff member)

= Annual net working hours

==========

(III) Hourly rate = (I) : (II)

==========

ad (2) Overhead of the research department

The percentage by which undistributed costs of the department are charged to every project is calculated as follows:

$$\frac{\text{Annual undistributed costs of the department (overhead costs)}^{1)}}{\text{Total of annual staff expenses charged directly to projects (direct personnel costs)}} \times 100$$

For the calculation of the percentage the overhead costs and the direct personnel costs are taken from the last year or - better - from budgeted values for the current year; they may be different for each department.

The monthly account of the department (and any other cost center) will show the monthly balance of all costs of the department and all revenue from overhead charged to projects in the percentage as calculated above (or, for a service unit operated as a separate cost center: of revenue from services rendered to the departments)[2)].

---

1) possibly reduced by fixed contributions to the department

2) see also under c)

ad (4) General overhead of the Institue

Here, the same applies as in the comments ad (3), but the percentage will be the same for projects of each department. There may be a distinction, however, between different types of projects (e.g. on account of different terms of payment or sponsors - the first differentiation being made with regard to the cost, the second owing to price considerations).

ad (5) Material costs, etc.

These comprise for instance

goods in stock
supplies and services from outside
mail, telephone, telegramfees, etc.
travel expenses

as far as they can be assigned to specific projects. If not, they will usually be included under (2) or (4).

ad (6) Costs of internal services

These comprise services, such as

driving services
duplicating, printing, drawing, photography
maintenance service
use rate for the computer or other expensive special equipment
translating office

as far as internal price standards are used for these services and they are not included as general overhead under (4).

All these service units will have monthly accounts with their costs incurred as debit entries and their revenue for services carried out as credit entries (see comments to (2)).

The organisation of the internal service units as separate cost centers promotes efficiency by motivating the responsible head of the unit to cost reduction and measures for better utilization of the available capacity; it may prevent investments not really profitable.

ad (8) Surcharge on the total material and service costs

The surcharge is supposed to cover costs of general administration incurred by procurement of material and use of services. It may be as high as 3-5 percent and may, in a more simple form of cost accounting, be dispensed with, if there are no large differences in the percentage of material costs in the various projects.

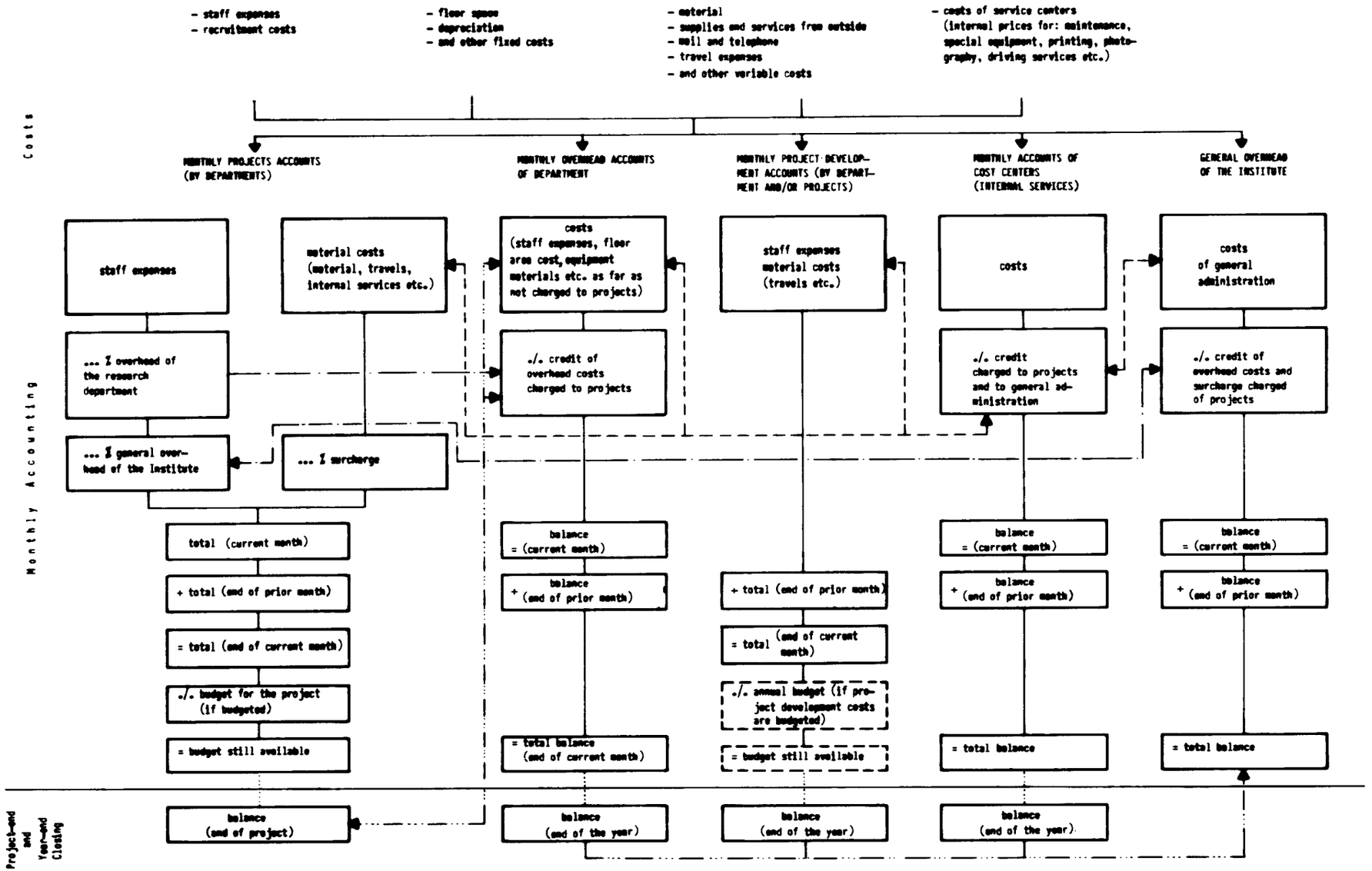

ILLUSTRATION OF COST ACCOUNTING SYSTEM

c) Monthly accounts of project costs and cost centers

For every project monthly accounts are to be issued, showing:

1. Costs incurred for the current month
2. Costs incurred in the previous months
3. Total cost (1 + 2)
4. Budget for the whole project (if a budget has been prepared)
5. Budget still available (4 ./. 3)

For every department or any other organisational unit operated as a separate cost center (service units, etc.) the monthly account will include (see also under a) and (2)):

1. Costs incurred for the current month
2. Revenue of the current month
3. Balance of the month (2 ./. 1)
4. Balance of the previous months
5. Total balance (4 + 3)

A permanent debit balance will require a increase of the percentage of overhead charged, and vice versa, or an increase of "prices" for services rendered, unless it is defined policy the keep prices low and cover losses by subsidies.

d) Some organisational requirements for the introduction of cost accounting

Preparatory operations for the introduction of cost accounting would comprise:

- Elaboration of a chart of accounts

  for cost centers:

  -- for each research department (with possible sub-accounts)

  -- for each service unit to be operated as a separate "profit" center (by charging its services to the research departments and to general administration)

  -- the same applies to "auxiliary cost centers" to gather all costs for the establishment of a price standard: all personnel costs (see a) ad 1)), all costs relating to space area used (depreciation on buildings, maintenace, residence taxes and insurance, building management, electric power and water used, cleaning), all cost relating to expensive machinery or equipment (depreciation, maintenance, electric power, space room used, insurance etc.)

  -- for general administration (possibly with sub-accounts for the various units)

  for projects:

  -- account number for each project or project group, best to be issued by a separate organisational unit "contract administration" (connected to the legal advisory staff);

for project development, with subaccounts for departments and possibly for projects or project groups

- Elaboration of forms for the statement of costs charged to projects or cost centers
  - -- time sheets for hours worked
  - -- cost cards or lists etc. for material, telephone, driving services etc.
- Determination of how to treat subsidies in cost accounting. In principle subsidies may be used
  - -- to diminish costs in general (e.g. by financing investments)
  - -- to subsidise specific projects or sponsors (e.g. by lowering overhead rates)
  - -- to finance special projects completely (e.g. basic research, pilot studies, training of staff members).

  The last possibility should be perferred.
- Determination of overhead rates and "prices" to be charged by internal cost centers, on the basis of budgeted costs and anticipated utilisation of capacity. In special cases marginal pricing should be preferred; unused capacity has then to be paid from the general overhead or by subsidies.
- Monthly data processing including elaboration of forms for monthly cost reports.

e) Rate of sophistication

The system should not be too complex: it is better to start with a limited number of accounts and subaccounts and to treat minor costs as overhead and to assign them to projects not too meticulously. High sophistication is not necessary for pricing (and, indeed, a system may be faulty as a basis for pricing in spite of high sohpistication). The same applies to cost control; an appropriate formation of accounts is more important than too great a subdivision.

It will be much easier to make a system gradually more sophisticated, if required, than to do away with uneconomical oversophistication.

LISTA DE APLICAÇÕES DE COMPUTADOR NO IPT

- Projeto do Navio auxiliado pelo computador.

  Uma série de programas escritos em Fortran, relativos a: especificações preliminares, avaliação de desempenho, projeto estrutural de navios baseados em considerações de ordem teórica, experimental ou ambas. Outros programas estão sendo desenvolvidos e serão integrados eventualmente em um sistema.

  Êeste trabalho é feito pelo IPT junto com o Escritório Técnico de Construção Naval (grupo na Escola Politécnica da Universidade de São Paulo e pela (Marinha), com a colaboração do MIT.

  Principalmente interessado neste sistema está a SUNAMAM (Superintendencia Nacional da Marinha Mercante).

- Método dos Elementos Finitos

  Uma séria de programas e subrotinas relativas ao método dos Elementos Finitos, essencialmente um procedimento orientado para o computador de solução de problemas de condições de contorno.

  Duas áreas principais estão desenvolvidas.

  a) Básica: programmas e subrotinas para diferentes elementos: TRIM3, TRIM6, TRIM10, TRIM 4.

  b) Aplicada: aplicação do método a problemas especificos de projeto estrutural e percolação através de meios porosos.

- Programação Matemática

  Desenvolvimento de programas e enlatados sôbre: Programação Linear; Programação Dinâmica: Algoritmos Especiais; implantação e aplicação de enlatados.

- Probabilidade e Estatistica

  Desenvolvimento de programas sôbre:
  Análise de Variancia, Testes de Aderência, Análise Fatorial e implantação de enlatados tais como o SSP da IBM.

- Projete "Instituto de Pesca"

  Este projeto está sendo desenvolvido por requisição do Instituto de Pesca da Secretaria de Agricultura do Estado de São Paulo. Envolve codificação, geração e atualização de arquivos, definição de índices de produção e correlação de produçao e caracteristicas de todos os barcos des pesca operando a partir do pôrto de Santos.

- Mapeamento dos Usos do Solo na Cidade de São Paulo

  Este projecto, feito por requisição da Administração Municipal, - envolveu a determinação de índices de uso de solo (comercial, industrial, ocupação, etc.) de cada quadra na Cidade de São Paulo, baseado nos arquivos usados para recolhimento de impostos territorial e predial.

Appendix 8

LIST OF SOME DOCUMENTATION PROBLEMS TO BE ATTACKED IN SHORT TIME*)

1. Selective Catalogue of building materials

It would involve comparisons, listing quality and specifications. No such work exists in Brazil. In view of the proportions of building industry in Brazil, this catalogue is extremely necessary.

2. Elaboration of a technological thesaurus

Various areas would be attacked to show the opportunity of the initiative, it is assumed as example the area of building and urban planning, wherein:
Abstracts of books in various fields are being made by different groups. In the field of urban planning and building in general about 100 abstracts have already been made. Another work group in the adjacent area of building materials, especially chemistry of building materials, have already catalogued about 500 books.
There has been no coordination of groups and the works cannot be added for lack of definition of a basic thesaurus.
Similar cases occur in other areas.

3. Standards and specifications, and library

There is important work to be done in the Standard and Specification Sector and the Library of the IPT.

4. Integration in the national network

There is an out line of a national documentation information network coordinated by the IBBD (Brazilian Institute of Bibliography and Documentation), comprising 441 libaries referring to periodicals.
In what refers to technology in general, in only few areas of specialization there is work, and there are big gaps.

5) Internal Documentation

The IPT is in need of an accompanying system for its internal documentation, technical and administrative.
It is also in need of implementing a general protocol and accomanying the follow-up matters.
The attack of these problems have been defined with a specific project.

6) Information Storage and Retrieval

The development of software and planning of information systems in being sudied by the IPT, an pioneer accomplishment in Brazil.
The IPT have cultivated international relationships in this field, going through surveys of data and collection of information and observations in various countries.

*) Translation by IPT

Appendix 9/1
METALLURGY

Graduate Personnel by Capacity and Specialisation

Name and Title	Branche of Science and Specialisation	Post Graduate Studies	Years with IPT
RENATO PAPALÉO - Technical Assistant of Division - Head of Physical Metallurgy Group	Metallurgy Mechanical Metallurgy	Ph.D. at Sheffiedl	8
EDUARDO CAMARGO DE OLIVEIRA PINTO - Technical Assistant of Division - Head of Chemical Metallurgy Group	Metallurgy Iron and Steel	"Mestre em Engenharia"	8
HÉLIO DE LIMA CARVALHO - Technical Assistant of Division - Head of Pilot Plant Foundry	Metallurgy Non-Ferrous Alloys Casting		5
PAULO SÉRGIO PEREIRA DA SILVA - Technical Assistant of Division	Metallurgy Mechanical Metallurgy	M.Met.; Ph.D. at Sheffield	8
STEPHAN WOLYNEC - Technical Assistant of Division	Metallurgy Corrosion	Ph.D. at Sheffiedl	8
RENATO ROCHA VIEIRA - Technical Assistant of Division	Metallurgy Phase Transformation	"Doutor em Metalurgia"	2
NORIYUKI SUGIYAMA - In charge of Technical Sector	Metallurgy Cast Iron	"Mestre em Engenharia"	7
ANA MARIA M. MORAIS ADAM - In charge of Technical Sector	Chemistry Corrosion	"Mestre em Engenharia"	1
RUBENS HABESCH - In charge of Technical Sector	Metallurgy Non-Ferrous Extraction	"Mestre em Engenharia"	9
HENRIQUE PEROTTA RIZZO - In charge of Technical Sector	Metallurgy Iron Ore Reduction	"Mestre em Engenharia"	7
FERDINANDO LUIZ CAVALLANTE - In charge of Technical Sector	Metallurgy Physical Chemistry of Metals		4
CLÁUDIO LUIZ MARIOTTO - In charge of Technical Sector	Metallurgy Moulding Materials		8
MILTON RAMOS - In charge of Technical Sector	Metallurgy Iron and Steel		3
JOSÉ ORTEGA TORAL - In charge of Technical Sector	Metallurgy Metallography		4
JORGE AUGUSTO GOUVÊA - In charge of Technical Sector	Metallurgy Solidification of Metals		4
LUCIANO J. MEDEIROS GOOSSENS - In charge of Technical Sector	Metallurgy Iron and Steel Casting		3

Appendix 9/2

METALLURGY

Continued:

Name and Title	Branch of Science and Specialisation	Post Graduate Studies	Years with IPT
RONALD LESLEY PLAUT - In charge of Technical Sector	Metallurgy Rolling		3
TOSHIYUKI KURONUMA - In charge of Technical Sector	Metallurgy Non-Destructive Tests		1
ERNESTO WIERING - Engineer	Metallurgy Steel		2
FRANKLIN EVRARD - Engineer	Metallurgy Metallography		2
JORGE ISHIDA - Engineer	Metallurgy Welding		2
SOLON Y. TAGUSAGAWA - Engineer	Metallurgy Precision Casting		2
BARNABAS BELCSAK - Engineer	Metallurgy Metallography		1
ALCINDO MÁRCIO LUDOVICE - Engineer	Metallurgy Metallography		1
REINALDO INFANTE MONTEIRO - Engineer	Metallurgy Casting of Non-Ferrous Alloys		1
WILSON ZAFALON - Engineer	Metallurgy Casting of Iron and Steel		0,5

Appendix 10

METALLURGY

MAIN EQUIPMENT

Available Equipment

1 triphase electric furnace - 1 ton - 1942
1 arc furnace - 500 kg - Detroit - 1942
1 coreless induction furnace - 100 and 25 kg - Ajax - 1944
2 crucible oil furnaces - 200 kg - Fischer - 1948
1 vacuum induction furnace - 5 kg - Stokes - 1969
2 oil furnaces for heat treatment - W.S. Rockwell - 1948
1 electric furnace for heat treatment - General Electric - 1948
1 gas nitriding furnace - Homo - 1948
3 salt-bath furnaces - Ajax - 1946
1 oil furnace for heat treatment - Heating (Bras.) - 1970
Semi-automatic system for sand preparation - 1944
Moulding system - 194[illegible]
Equipment for "shell moulding" process - Roterid (Bras.) 1971
Equipment for investment casting - 1969
Equipment for moulding material testing and control - 1956
1 die forging hammer - 500 kg - Chambersburg - 1948
1 die forging hammer - 500 kg - VSS - 1969
1 laboratory rolling mill - Stanat - 1968
Equipment for X-ray testing - 1969
1 recorder Potentiometer - Speedomax - 1966
1 transformer for constant tension - Eletromar (Bras.) 1971
1 electrometer - Vibron (Bras.) 1971
1 lathe - Sanches Blanes (Bras.) 1971
1 Metallograph Leitz MM 5 PX - Leitz - 1965
1 camera with accessories - Sinar - 1971

Ordered Equipment

Equipment for TIG welding
Equipment for MIG welding
Equipment for submerged arc welding
Horizontal-Spindle grinding machine
Potentiometric recording pyrometer
Horizontal drill
Diffractometer and diffraction equipment
Equipment for investment casting
Brazil: US $ 24,000
U.S.: US $ 45,000

Projects Completed and Underway since 1-1-1970

Routine work and trouble-shooting

- Oxidation-resistant high aluminium cast iron with nodular graphite
- Stainless-steel refining by oxygen injection in electric furnace
- Some concepts required for high-strength grey cast iron moulding
- Investigation of residual stress in cemented gears by means of stress corrosion
- Experimental study on the influence of calcium-silicon on the strength of grey cast iron
- Residual temions in gears and cemented pieces
- The utilization of iron ore fines and charcoal for producing metallic iron
- A comparative study of methods for calculating runners for grey iron
- Microfractography - Introduction to the topographical characteristics corresponding to the various micromechanisms of fracture
- Steel processing in the induction vacuum furnace
- Precision cating in ceramic mould: surface defects of AISI H-13 steel pieces
- The problem of metal-mould reaction in the case of AISI H-13 steel cast in ceramic mould

Research and development

- Technology for investment casting
  Sponsor: FAPESP - São Paulo
- Moulds for titanium casting
- Cast iron desulfurization
  Sponsor: FAPESP - São Paulo
- Characterization of abrasion resistance of hard-facing arc-welded deposits
  Sponsor: Construtora Camargo Correa - São Paulo
  (Convênio IPT-Camargo Corrêa)
  Projects sponsored by COSIPA - São Paulo
  (Convênio IPT-COSIPA)
- Bottom plates and ingot moulds
- Improvement of the performance of rolls for hot rolling
- Atmospheric corrosion of sheet steel
- Use of Brazilian coal in the sintering of iron ores
- Treatment of Brazilian coal by fluidization

Survey of the Routine-Work

Certifications

During 1970 the Metallurgy Division made 87 certifications, involving tests, analyses, etc.

Distribution of certifications:

- Moulding materials	5
- Steels	2
- Corrosion and surface treatment	4
- Metallography	76
- Total	87

Revenue from these services: US $ 7,000.

For 1971 the same level of activities is estimated.

Trouble Shooting

During 1970 35 reports were made:

- Metallography	21
- Corrosion	14
- Total	35

Revenue from these services: US $ 6,000.

1971: same level of activities.

Pilot Plant Foundry Services

Production of alloys and castings during 1970:

- Steel castings	12 tons
- Iron castings	27 tons
- Non-ferrous castings	8,5 tons

Revenue: US $ 45,000.

For 1971 an increase in activities of about 20 percent is estimated.

Graduate Personnel of the Mechanical Engineering Division

Name and Title	Branch of Science	Specialisation	Post-Graduate Studies	Years with IPT
Joaquim Carlos Teixeira Riva - Head of the Cavitation Tunnels	Naval Engineering	Fluid Dynamics Computations	None	4
Manoel de Andrade e Silva Reis - Assistant of the Cavitation Tunnel	Naval Engineering	Instrumentation for Naval Engineering Laboratories	None	3
Toshi-ichi Tachibana - Head of the Towing Tank	Naval Engineering	Towing Tank Tests	None	3
Isao Miwa - Assitant of the Towing Tank	Naval Engineering	Towing Tank Tests	None	1
Fausto Furnari - Assistant of the Thermal Engineering Group	Mechanical Engineering	Thermometry and Heat Transfer	None	1
Oswaldo Ziober - Assistent of the Instrumentation Laboratory	Electronic Engineering	Numerical Control	None	2
Francisco Emilio Baccaro Nigro - Head of the Control Laboratory	Mechanical Engineering	Hydraulic Controls	None	3
Oswaldo de Oliveira Cuimarães Filho - Assestant of the Control Laboratory	Electronic Engineering	Numerical Control. Electronic Feed-Back System	None	2
Sérgio Augusto de Souza - Head of the Machanical Testing Laboratory	Metallurgical Engineering	Mechanical Materials Testing	None	10
Paulo Mário Rodrigues da Cunha - Head of the Vibration Laboratory	Mechanical Engineering	Machine Tool Dynamic Tests	None	3
Remo Alberto Pierri - Assistant of the Vibration Laboratory	Mechanical Engineering	Instrumentation and Vibrations	None	3
Waldir Delano Abu Gannam - Head of the Machine Tool Laboratory	Mechanical Engineering	Machine Tool Tests	None	3
Walter Link - Head of the Metrology Laboratory	Mechanical Engineering	Industrial Metrology	Industrial Metrology and Machine Tool Manufacture	3

Appendix 13/2

MECHANICAL ENGINEERING

continued:

Name and Title	Branch of Science	Specialisation	Post-Graduate Studies	Years with IPT
Manoel Adolpho Silveira Vasconcellos - Head of the Industrial Equipment Section	Mechanical Engineering	Testing of Industrial Equipment	None	8
Augusto Reis Mazzeo - Head of the Machine Design Office	Mechanical Engineering	Machine Design	None	5
Rolando Turini - Head of the Instrumentation Laboratory	Electronic Engineering	Analogical Systems	None	3
Aldo Andreoni - Technical Assistant	Civil and Naval Engineering	Naval Architecture Laboratory	None	27
Marcilio Villela Bastos - Head of the Machine Tool Group	Mechanical and Electrical Engineering	Production Engineering	None	3
Paulo Cesar Leone - Head of the Naval Engineering Group	Mechanical and Naval Engineering	Applied Mathematics and Fuid Mechanics	M.S. in Mechanical Engineering and Naval Architecture, Ph.D. in Fluid Mechanics	9
Ruy Borges da Silva - Head of the Instrumentation and Control Group	Physicist	Scientific Instrumentation	Instrumentation for Analytical Chemistry and Inosphere and Geophysics Research	5
Flávio Pinheiro Ávila - Head of the Materials Testing Group	Civil Engineering	Vibration and Demolition Work	None	12
Inah Rosa - Head of the Mass and Dynamometry Laboratory	Civil Engineering	Weight Measurement Activities	None	15
Saburo Ikeda - Assistant of the Thermal Engineering Group	Mechanical Engineering	Heat Transfer and Combustion	None	1
Antonio Cantizani Filho - Assistant of the Machine Tool Group	Mechanical Engineering	Research and Production Administration	Research Project Administration	3
José Cesário Raimundez Alvarez - Assistant of the Machine Tool Group	Mechanical Engineering	Production Analysis Group Technology	None	2

Equipment

Machine Tool Laboratory

A collection of selected types of machine tools including lathes, milling machines, shapers, horizontal boring and milling machine, surface and cylindrical grinders, tool grinders, numerical control drilling machine, gear hobbing and gear shaping.

Metrology Laboratory

Complete linear measurement equipment except for light and laser interferences.

Vibration Laboratory

Electrodynamic exiters, displacement, velocity, Acceleration, force and pressure transducers, tracking filters, synchronous and linear amplifiers, charge amplifiers, strip chart recorders, ultra-violet recorders, storage oscilloscopes, sound level meter, balancing machines.

Instrumentation and Control Laboratories

Well-equipped electronic laboratory for the manufacture of special electronic interfaces for measuring equipment and for the maintenance of the electronic equipment of all laboratories of IPT. Control laboratory with high-pressure hydraulic system, flow meter, pressure gauges, dynamometers, testing benches for hydraulic power systems.

Mechanical Testing Laboratory

Comprising mechanical testing machines ranging from 500 kg f. to 500,000 kg f. ts.

Naval Engineering Laboratories

A 140 m towing tank with the required peripheral equipment for the manufacture of ship models and a cavitation tunnel.

Appendix 15/1
MECHANICAL ENGINEERING

Projects completed and under way since 1-1-1970

"Construção de instrumento para medida e registro contínuo do êrro de eistemas de avanço de máquinas ferramentas" - IPT - 6 months - Cr£ 10,000 - Research

"Projeto e construção de fresadora horizontal de 100 mm". - IPT - 4 years - Cr$ 800,000 - Machine Tool Design

"Projeto e construção de servo mecanismo para o contrôle de velocidade de hélices de modêlos de embaração - IPT - 6 months - Cr$ 5,000 Research

"Projeto e construção de luxômetro para modêlos de habitações" - IPT - 2 months - Cr$ 3,000 - Research

"Estudo de trens fluviais" - CENAT - 1 year - Cr$ 40,000 - Convênio

"Estudo de Propulsores em água aberta" - IPT - 1 year - Cr$ 6,000 - Research

"Estudo de auto-propulsão de navios fluviais" - CENAT - 1 year - Cr$ 20,000 - Convênio

"Desenvolvimento de programas para o cálculo de caracteristicas de aferição de hélices" - IPT - 6 months - Cr$ 20,000 Research

"Desenvolvimento de programa para o cálculo de hélices" IPT - 4 months - Cr$ 15,000 - Research

"Desenvolvimento de programas para o desenho de hélices" IPT - 4 months - Cr$ 15,000 - Research

"Desenvolvimento de programas para a redução de dados de túnel de cavitação - IPT - 6 months - Cr$ 20,000 - Research

"Estudo sistemático de lemes" - IPT - 2 years - Cr$ 30,000 Research

"Projeto e construção de equipamento para medida de derivadas hidrodinâmicas" - IPT - 1 year - Cr$ 25,000 - Research

"Projeto e construção de dinamômetro de 5 componentes para corpos - submersos" - IPT - 6 months - Cr$ 5,000 Research

"Modêlo matemático para o estudo do comportamento de combôios fluvias em canais estreitos" - IPT - 6 months - Cr$ 10,000 - Research

"Estudo do problema da corrosão de vagões ferroviários por fertilizantes" - EFS - 6 months - Cr$ 12,000 - Research

"Estudo completo de uma retificadora interna Overbeck" HONING - 12 months - Cr$ 18,000 - Research

Appendix 16/1
CIVIL ENGINEERING

Graduated Personnel

Name and Title	Branch of Science	Specialization	Post-Graduated Studies	Years with IPT
A.D. Ferraz Napoles Neto - Division Director	Engineering	Geotechnology	Lehigh U. (U.S.A.)	28
C.A. de Abreu Maffei - Section Head	Architecture	Macro-Environment	-*)	3
Carlos Augusto Campanhã - Assistant	Engineering	Geotechnology	-*)	2
Carlos de Sousa Pinto - Technical Assistant to Director	Engineering	Geotechnology	M.Sc., Iowa S.U.	12
Clarisse Krisch - Administrative Officer	Pedagogy	Business administration	-*)	3
Claudio Sbrighi Neto - Assistant	Geology	Materials	-*)	1
Dalmo Altieri - Section Head	Physics	Materials	-*)	11
E.R.G. Ciccarelli - Assistant	Engineering	Structure	-*)	1
Emir Massad - Assistant	Engineering	Geotechnology	-*)	1
Eugenio Bonadio Neto - Assistant	Engineering	Materials	-	0,5
Faiçal Massad - Section Head	Engineering	Geotechnology	M.Sc., Harvard U., (USA)	2,5
Fausto Gomes Cavaleiro - Assistant	Architecture	Housing Planning	C.I.N.V.A. - O.A.S. (Bogotá, Colombia)*)	2
Francisco Pacheco Silva - Groupment Leader	Engineering	Geotechnology	M.Sc., Harvard U. (USA)	30
Henrique Zveibil - Assistant	Engineering	Geotechnology	-*)	4
Heraldo de S. Gitahy - Technical Assistant to Director	Engineering	Materials	-	25
Hiromiti Nakao (on leave) - Section Head	Engineering	Geotechnology	-*)	4,5
Jacob Aron Corch - Assistant	Architecture	Micro-Environment	-*)	2

*) Just taking, at the University of São Paulo (U.S.P.)

Appendix 16/2

CIVIL ENGINEERING

continued

Name and Title	Branch of Science	Specialisation	Post-Graduated Studies	Years with IPT
James Campanhã Alvim - Section Head	Engineering	Structures	-	5,5
L.A. Guimarães (on leave) - Assistant	Engineering	Materials	-	2
L.E.S. de Gouvêa Horta - Groupment Leader	Engineering	Structures	-	12,5
M. de S. Freitas Junior - Assistant	Engineering	Geotechnology	-*)	2
M.C. Reis Martins - Assistant	Engineering	Geotechnology	-*)	2
Marcia Peinado Alucci - Assistant	Physics	Micro-Environment	-	1
Maria Alba Cincotto - Section Head	Chemistry	Materials	L.C.P.C., CERILH. (France) I.C.A. - (Italy)	9
Maria Amélia Adissy - Section Head	Engineering	Geotechnology	-*)	2,5
Mariano de Mariano - Assistant	Engineering	Geotechnology	-*)	1
Mario Mori (on leave) - Section Head	Engineering	Geotechnology	-*)	3,5
Norio Enomoto - Assistant	Engineering	Materials	-	0,5
Paulo Segio Dib - Assistant	Engineering	Geotechnology	-*)	0,5
Renato Tagliavini - Assistant	Engineering	Geotechnology	-*)	2
Roberto Barbosa - Assistant	Engineering	Geotechnology	-*)	2
S.A.W. Vasconcellos - Assistant	Engineering	Transportation	-*)	1
S.A. Guedes (on leave) - Assistant	Geology	Materials	Just taking at CSTB (France)	3
Sergio Simordi - Groupment Leader	Engineering	Materials	CSTB - (France) CSTC - (Belgium)	10
Simão Priszkulnik - Section Head	Engineering	Materials	CSTB - (France) LNEC - (Portugal)	8
Yasuko Tezuka - Section Head	Engineering	Materials	Utsunomya U. (Japan) *)	4

*) Just taking, at the University of São Paulo (U.S.P.)

Projects completed and published since 1-1-1970

- Método numérico para determinação do coeficiente de adensamento.
- Considerações sôbre o uso dos elementos finitos em problemas de percolação.
- A determinação da resisténcia ao cisalhamento dos solos da Barragem de Ilha Solteira.
- Resisténcia e deformabilidade em ensaio não drenado de um solo compactado.
- Medidas de pressão de terra em escoramento de valas.
- Deformação elásticas de maciços rochosos de fundações e barragens de gravidade causadas pelo enchimento.
- Notas sôbre resistência ao cisalhamento dos solos.
- Descrição de um centro de estudos da habitação e análise de alguns aspectos da produtividade da construção na região de São Paulo.
- Distribuição da tensõs em ensaios de sicalhamento usualmente usados em mecânica das rochas - la etapa: meios elàsticos, isótropos, contínuos.
- Sôbre a medida de resistência à penetração em sondagens.
- Resistência ao cisalhamento dos solos variegados da Cidade de São Paulo.
- Pressões de terra sôbre caixas rígidas enterradas em solos compactados.

Appendix 18/1

MINING AND APPLIED GEOLOGY

Graduate Personnel

Name and Title	Branch of Science	Specialization	Years with IPT
Luiz Francisco Rielle Saragiotto + Geologist	Applied geology		5
Fernando Pires de Camargo Geologist	Applied geology and rock mechanics		8
Guido Guidicini Geologist	Applied geology	Foundation of dams	2
Niza Silva Jardim Geologist		Documentation	1
Antonio Manoel dos Santos Oliveira Geologist	Applied geology	Foundation of dams	3
Lindolfo Soares Geologist	Applied geology	Dams	2
Albert Thomas de Cornides Geologist	Applied geology	Dams	1
Vinicius Gomes Taveira Mano Geologist	Applied geology	Dams	1
Manuel Lucas Novo Geologist	Applied geology	Dams	1
Egmont Bastos Capucci Geologist	Applied geology	Geological mapping	0.5
João Alberto Nery de Oliveira Geologist	Applied geology	Dams	5
Romualdo Homobono Paes de Andrade Geologist	Applied geology	Dams	2
Miguel Carlos Andreotti Geologist	Applied geology	Building of canals	1
Miguel José Nuske Geologist	Applied geology	Dams	2
Jesus Sebastião Araújo Geologist	Applied geology	Dams	2
Antonio Roberto Rodrigues Geologist	Applied geology	Geological and geochemical studies for dam-building	3
Abílio Fábio Nunes Geologist	General geology	Geological mapping	0.5
Augusto Paiva Filho Geologist	General geology	Geological and geochemical studies	1

continue

Name and Title	Branch of Science	Specialization	Years with IPT
Waldir Lopes Ponçano Geologist	General geology	Geological and morphological studies	1
Alcides Frangipani Geologist	Hydrology	Hydrological studies	2
José Pompeu dos Santos Geologist	Hydrology	Hydrological studies	1
José Eduardo Siqueira Farjallat Geologist	Petrology	Applied petrology	3
Evaristo Pereira Goulart Geologist	Petrology	Applied petrology	2
Ana Maria Pocciotti Geologist	Applied geology	Rock mechanics	1
Carlos Takeshi Tatamiya Geologist	Applied geology	Rock mechanics and concrete injection	2
Luiz Geraldo Caruso Geologist	Applied geology and engineering	Rock mechanics	2
Riuiti Yoshida Geologist	Applied geology	Rock mechanics	3
Carlos Manoel Nieble Engineer	Mining engineering	Rock mechanics	5
Hugo Takahashi Engineer	Mining engineering	Rock mechanics	1
Fernando Fujimura Engineer	Mining engineering	Rock mechanics	2
Nilson Figueira Medéa Engineer	Mining engineering	Rock mechanics	5
Wagner Simões de Carvalho Engineer	Mining engineering	Mineralogy	2
Ricardo Fernandes da Silva Geologist	Applied geology	Dams	4
Jairo Sant'Anna Taddeo Geologist	Geophysics	Geoelectrical measurements	3 months
Victor Luiz de Oliveira Meyer Geologist	Geophysics	Seismic studies	1

Equipment Available

Nome do Aparelho	Para que Serve	Fabricante	Ano
Balança "Westoha Bosch"	para pesar material	Bosen	1938
Classificador "OEISTER" de uma célula mod. de laboratório com câmera separadora e decantadora de vidro de 6"		Deister	1939
Porômetro Kasper Richter Ref - 123	medir distâncias		1939
Hidrômetro tipo de deslocação	para medir água		1961
Hidrômetro tipo "IGUASSU" 2" 30 m^3/hora	" " "		1965
Macaco hidráulico c/capacidade de 300 toneladas c/contrôle a distância por meio de 2 alavancas, curso 150 m/m, mangueira de 2 m manômetro 0-1000 kg	Ens.Mec. Rochas	Equip.Ind.Pintemac	1965
Idem Idem	" "	" "	1965
Macaco hidráulico para 50 toneladas, curso de 150 m/m, com bomba manual, manômetro e tubulação c/3 metros.	" "	" "	1966
Idem Idem	" "	" "	1966
Aparelhos de medidas e deformações em peças submetidas a tensões, consistindo de indicador tipo PS7/h e, caixa de mudança tipo PS7/5s no. 67409	p/medir deformações		1969
Equipamento RS-4	Medidas sísmicas	SOILTEST	1969
Analisador termo diferencial (DTA) modêlo Thermoflexe	Análises térmicas diferenciais	Rigaku-Denki	1969
Concentrador Eletromagnético	concentração eletr. de minerais	Franz	1969
Acessórios opticos	Fotografia, Micros cópia, índice de refração, etc.	Leitz,Carl Zeiss, Asahi-Pentax	1969
Aparelho strator hidráulico			1969
Nível-suiço marca Wild n-10 leitura invertida No. 179655	p/nivelador terreno	Honda	1969
Indicador Universal, tipo CM-4F, c/6 medidas de deformações em junta de concreto, tipo CJ-SE-E, caixa de mudança tipo NS6E.	p/indicar deformações		1969
Alimetro sistema Paulin, Mod.Palev-Universal, escala com leitura de 1 m/e limites: 30x3.200 m/m	p/medir altura		1970
Serra de diamante no. 0462/069, tipo DL-30, para granito D-450 m/m, velocidade de 1700 a 1900 RPM	p/serrar rochas		1970

Appendix 19/2

MINING AND APPLIED GEOLOGY

continue

Nome do Aparelho	Para que Serve	Fabricante	Ano
Espectro Colosimetro	Análises Espectro-Coloumétricas	Bausch-homb	1970
Altimetro sistema pulin, mod.palev - universal palev, escala de leitura de 1 m e limites de 340 a 3200	p/medir altura		1970
Aéreo Sketchmaster Luz, "ZEISS" (aparelho para restituição de fotografias aéreas) número de ordem 515701 e 115344	p/medir fotografias	Carl Zeiss	1970
Sismografo Registrador	Trabalho de sísmica p/Engenharia	W.F. Sprengmether	1970
Estufa mod. 315/5, para temperatura até 200°C, dimensões internas 60x50x60 cm com prateleiras, no. 56641		Fanem Ltda	1970
Transceptor de (SSB-3A-35) 100 W Pep. de Pot., serviçio simples, na fiaxa de 2 a 15 MHZ p/operar em 2 canais de RF., nas freq. de 6.830 e 13.420 HZ, com microfone de mão e fonte de altimenta - çao p/110 v. n-3153	Transmitir mensagem	Telefunken	1970
Viscosímetro Fann, Mod. 35, 11 V. 60 CPS., compleo c/Rotor R1 cilindro B1, mola F1 e copo de amostra de aço inoxidável, c/acessórios	p/verificar viscosidade de materiais	Fann	1970
Equipamento RS-4		SIE	1970
Equipamento "TERRASCOUT"	Medidas sísmicas	SOILTEST	1970
Equipamento R-50	Medidas elétricas	SOILTEST	1970
Equipamento R-40	Medidas elétricas	SOILTEST	1970
Estereoscópio de espelho (3 unidades)	Interpretação de fotos aéreas	WILD	
Estereoscópio de bolso (2 unidades)	" "	DF-Vasconcelos	
Bússola de campo (2 unidades) tipo BRUNTON	Orientação no campo	FUJI	
Equipamento ou Difração de Raio X modelo Geigerflese	Análise de Raio X	Rigaku-Denki	1970
Registrador XY de 12 canais, para registro automático da curva tensão x deformação	Ensaios de cisalhamento direto	KYOWA	1970
Catetômetro	Observações de deformações verticais de fundações de estruturas	WILD	1970
Nivel eletrônico	Observação de inclinações de funções de estruturas	TALYVEL	1970

continue

Nome do Aparelho	Para que Serve	Fabricante	Ano
Borehole Deformation Gauge	Medir tensões em furos de sondagens	SOILTEST	1970
Câmaras Triaxiais	Medida de deformações de rochas	IPT	1970
Calculadora		SHARP	1970
Máquina vibratório marca Produtest, Mod. T, para análises granulométricas, c/possibilidade de 8" de ∅ e 2" de altura ou 11 panelas de 1 altura	p/peneirar material	TALESTEM LTDA	1970
Máquina para serrar rochas "in situ", com motor Arno ER.80D.	Prep. Amostras	IPT	1970
Transceptor SSB, mod. RTH-94/4, no. 495, composto de uma fonte de alimentação p/110 - 220 VCA mod. FIA-94/CA, no. 412 e, um microfone mod. MCA 94.	Comunicação entre Sede e Residências Técnicas	Telefunken	1971
Transceptor portátil 110 wats em SSB, 1 canal - frequência 6.830 HZ, alimentação 110 ou 12V com antena dipolo 3 a 15 MHZ ato, com 15 m cabo..	Idem Idem	Idem Idem	1971
Transceptor portátil 110 wats em SSB, 1 canal - frequência 6.830 HZ, alimentação 110 a 12V com- antena dipolo 3 a 15 MHZ ato, com 15 metros cabo	Idem Idem	Idem Idem	1971
Idem Idem	Idem Idem	Idem Idem	1971
Transceptor SSB, mod. RTH-94/1 no. 496, com fonte de alimentação e microfone de mão.	Idem Idem	Idem Idem	1971
Transceptor Spetronic mod. XR-5027 classe B	Idem Idem	AJ Eletrônica S/A	1971
Transceptor Spetronic mod. XR-5027 classe B	Idem Idem	Idem Idem	1971
Transceptor de SSB mod. XR 105 em faixa lat. sing. (SSB - 3 a 35) 100 W dep. de pot. servi. simples, na faixa de 2 a 15 MHZ, prep. em um canal de RF na freq. de 6.830 HZ com microfone de mão.	Idem Idem	Telefunken	1971
Espectrofotômetro "SPECTRONIC-20", Bausch, completo no. 6538TB	P/espectrofotometria		1971
Peneira separadora, de laboratório, "Denver", mecanismo vibrador Denver de 8", movido p/motor 1/6 HP, 56. peneiras de 8" Tiler p/10-20-28-35-48-65-100-150.	P/separar material	Denver	1971
Viscosimetro Fann, Mod. 35, 1 5 V. 60 CPS., completo, c/Rotor R1 cilindro B1, mola F1 e copo de amostra de aço inoxidável, c/acessórios.	P/verificar viscosidade de materiais	FANN	1971
Computador de mesa - mod. 9810 A		Hewlett-Packard	1971
Equipamento AD-71	Medidas eléctricas	IPT	1971

Appendix 19/4

MINING AND APPLIED GEOLOGY

continue

Nome do Aparelho	Para que Serve	Fabricante	Ano
Nivel-sueço marca Wild N-10 leitura invertida no. 179655	P/nivelar terreno	Wild	1971
Teodolito japonês marca Sokkeicher prumo ótico TM-20 no. 76659	P/nivelar terreno	Sokkeicher	1971
Estufa S.E. retilinea fabricação Fanen modêlo 315/1 N-60812	Secar Material	Fanen Ltda	1971
Altimetro sistema paulin, mod. palev - universal escala de leitura de 1 m, e limites de 340 a 3200	p/medir altura		1971
Balança de precisão marca Mettlen, mod. P3, no. 324802	p/pesar material	Mettler Instrument AG	1971
Balança Analítica com indicador digital até 0,1 mg de capacidade 160g no. 289.095	p/pesar material	Bosen	1971
Macaco hidráulico "Pontemac" tipo MH-1, cap. 25 toneladas curso 100 m/m altura fechado 200 m/m diâmetro de cabeça 54 m/m.	Ens.Mec. Rochas	Equip.Industriais Pontemac	1971
Idem idem	Idem idem	Idem idem	1971
Macaco hidráulico "Pontemac" tipo MH, capacidade 10 toneladas, c/bomba manual e manômetro	Idem idem	Idem idem	1971
Idem idem	Idem idem	Idem idem	1971

Fields of Activity broken up by Section

1. Seção de Geologia Aplicada

Altividades da Seção

- Investigações geotécnicas em fundações de barragens, pontes, escavações subterraneas, estradas, taludes, etc.
- Estudo de estabilidade de escavações de taludes naturais e artificiais.
- Estudo de permeabilidade de maciços rochosos.
- Investigação de campo e laboratório sôbre condiçoes de injetabilidade em maciços rochosos.

Métodos de operação

A - Assistência Técnica fornecida pelo IPT aos clientes na resolução de problemas tecnológicos específicos.

B - Apôio Tecnológico fornecido pelo IPT aos clientes através de equipes técnicas residentes nos diversos canteiros com funções predominantemente de contrôle de materiais de construção

2. Seção de Geofisica

Altividades da Seção

A Geofísica Aplicada (gravimetria, sismica, electrico, etc.) atua nos seguintes compos:

- Engenharia Civil
- Hydrogeologia
- Mineração

Métodos de operação

Todos os métodos geofísicos são realizados de um modo bastante semelhante: Mede-se na superfície do solo o parâmetro físicodas rochas que estão no sub-solo.

3. Seção de Geologia Geral

Atividades da Seção

O campo de atividades da Seção de Geologia Geral se restringe aos levantamentos geológicos, gemorfológicos e fotointerpretaçao de áreas que visam o fornecimento de dados geológicos,

geomorfológicos e geotécnicos necessários à determinação das viabilidades técnico-econômicas de construção de barragens, túneis, estradas, sistemas de irrigação, etc.

Métdos de operação

1) Trabalhos Preliminares (de escritório)

a) Pesquisa bibliográfica - visa obter maiores informações sôbre a geologia da área a ser levantada.

b) Aerofotointerpretação preliminar

c) Elaboração de mapas geológicos e geomorfológicos preliminares, com os dados fotointerpretados.

2) Trabalhos de Campo

a) Reconhecimento geológico e geomorfológico preliminares

b) Levantamento geológico e geomorfológico com a precisão desejada.

c) Levantamento geológico de secções tipo - caminhamento ao longo das seções.

d) Coleta de amostras representativas das litologias encontradas no mapeamento.

3) Trabalhos Complementares

a) Aerofotointerpretação final

b) Elaboração de mapas geológico e geomorfológico final

c) Elaboração de relatório descrevendo os aspectos geológicos, geomorfológicos e geotécnicos, com conclusões e recomendações.

4. Seção de Hidrogeologia

Atividades da Seção

Sua atuação abrange tanto a Geologia Geral como a Engenharia Civil. Em estudos hidrogeológicos regionais visando determinação das características hidrodinâmicas de formações geológicas como em estudos hidrogeológicos à Geologia Aplicada a engenharia.

Métodos de operação

- Mapeamento geológico
- Cadastramento de poços e fontes
- Estudos das variações do nível d'água

- Testes de bombeamento
- Perfuração de poços
- Análise de dados hidrometereológicos
- Análise química de águas.

5. Seção de Minas

Atividades de Seção

- Elaboração e acompanhamento de projetos de prospecção
- Elaboração de planos de lavra de médio e pequeno porte.
- Elaboração e acompanhamento de projeto de exploração de corpos de minéro.

6. Seção de Mecânica de Rochas

Atividades da Seção

- Fundações de Barragens

  Caracteriza o comportamento mecânico de fundações de barragens através de ensaios "in situ" e em laboratório. Estudo à estabilidade de taludes rochos. São realizados ensaios de sicalhamento direto, deformabilidade, triaxiais, ensaios com explosivos, etc. Acompanha as deformações sofridas pela fundações sofridas pela fundação com o enchimento do reservatório.

- Obras Subterrâneas

  Realiza ensaios para melhor posicionamento, dimensionamento e revestimento de obras subterraâneas. Estuda principalmente o estado de tensões virgens em maciços rochosos e as caracteristicas de deformabilidade de obras subterrâneas. Fornece dados para o dimensionamento de pilares de mineraçoes subterrâneas.

- Ensaios Dinâmicos

  Fornece as caracteristicas dinâmicas de maciços rochosos. Estuda os efeitos de vibrações devidos a explos oes.

Métodos de operação

- TRABALHOS DE ROTINA

  1. Em laboratório
     Ensaio de compressão diametral
     Ensaios triaxiais
     Módulo de elasticidade estático
     Fluência
     Módulo de elasticidade dinâmico e velocidade de propagaçãode ondas

- CISALHAMENTO DIRETO

2. "In situ"
   - Módulo de Deformação estático
   - Fluência
   - Módulo de elasticidade dinâmico
   - Determinação da relação carga distância
   - Ancoragem de vergalhoes
   - Cisalhamento Direto
   - Aderência Concreto - Rocha
   - Contrôle de Deformações em rocha

6. Seção de Petrologia (e Tecnologia de rochas)

Atividades da Seção

Seu campo de atividade se estende desde a Engenharia Civil - até a Mineração.

Métodos de Operação

Na parte de Petrologia faz-se:

- Identificação e descrição de rochas e minerais através de Microscópio petrográfico, técnicas de difração de Raio X e análise termo diferencial.

Na parte de Tecnologia de Rochas faz-se:

- No tocante a Engenharia Civil
  a. Classifcação de rochas para Trabalhos de escavação
  b. Propriedades índices de rochas para materiais de construção em concreto, pavimento de rodovias, fundações, enrocamento, etc.

No tocante da Engenharia de Minas.

  a. Comportamento de rochas sob a ação de equipamento ou processos especiais.
  b. Determinação de propriedades indices de rochas para escavação e beneficiamento de minerais.

Projects completed and under way since 1-1-1970

Title of Project	Sponsor	Time and Costs Budgeted	Character of Work	Routine Work	Trouble Shooting
Características reológicas de caldas de cimento	Centrais Elétricas de São Paulo S.A.	2/71-8/71 40.000 Cr$	Pesquisa de Laboratório visando avaliar a influência da variação de condições (viscosidade, temperatura, limite de escoamento, fator de sedimentação) nas características reológicas de caldas de cimento	aplicado em diversos casos	sem problemas especiais
Compressão puntiforme em fragmentos rochosos	IPT	11/70-11/71 30.000 Cr$	Verificar aplicabilidade e validade de compressão pontual para determinação na resistência à compressão simples	ainda não aplicado	sem problemas especiais
Determinação da Pressão em ensaios de perda d'água em sondagens	IPT	3/71-3/72 30,000 Cr$	Desenvolvimento de uma técnica de leitura direta da pressão efetiva de água em ensaios em sondagens	não aplicado ainda	construção e adptações de aparelhos especiais para se efetuar as medias
Injeção de cimento através de simulador de fendas	Centrais Elétricas de São Paulo S.A.	4/70-8/71 40.000 Cr$	Simular condições de injeção em fundações de barragens através de experiências em laboratório, obtendo informações sôbre a relaçao entre a abertura de fissuras da rocha e o tamanho dos grãos de cimento	não aplicado ainda	Problemas operaionais com o aparelho de tests
Estudo Geotécnico e tratamento de fundações de Barragens	Fundação de Amparo à Pesquisa do Estado de São Paulo e ACTIM (Agence pour la Coopération Technique Industrielle et Economique, France)	9 mêses 5,948 US $	Estágios em diversas entidades france - sas ligadas à Geologia Aplicada.		
Levantamento geológico das bacias de acumulaçao dos reservatórios, de Correntina, o Arrojado, Formoso, Xique-Xique e Irecê, Estado da Bahia	SUVALE	9 mêses 120.000 Cr$	Mapeamento geológico de locais críticos para a construçao de barragens (eixos e reservatórios), e/ou para abastecimento de água subterranea.		

continue

Title of Project	Sponsor	Time and Costs Budgeted	Character of Work	Routine Work	Trouble Shooting
Levantamento geológico da bacia do reservatório de Jequitaí – Minas Gerais	SUVALE	3 mêses (terminado) 45.000 Cr$	Mapeamento geológico para estudo de barragem (eixo e reservatório)		
Levantamento geológico do reservatório do Rio Cubatão – Estado de São Paulo	DAEE	3 mêses 30.000 Cr$	Mapeamento geológico para estudo de barragem		
Levantamento geológico dos rios Biritiba e Jundiaí– Estado de São Paulo	DAEE	3 mêses 25.000 Cr$	Mapeamento geológico para estudo de barragens		
Ensaios de cisalhamento e deformabilidade em laboratório e "in situ" – am materiais granulares	CESP	2 anos 150.000 Cr$	Estabilidade de Taludes em Barragens de Enrocamento		
Determinação de Tensões Virgens em Maciços Rochosos	IPT	3 anos 200.000 Cr$	Posicionamento e dimensionamento de obras subterrâneas – Rockbursts		
Ensaios de fluência "in situ"	CESP	2 anos 100.000 Cr$	Caracterização de deformação lenta em basalto		
Expansão em rochas basálticas	CESP	2,5 anos 150.000 Cr$	Determinação de pressões de expansão em rochas submetidas a umedecimento		
Ensaios triaxiais em rocha com medidas de deformações internas à câmera	IPT	1 ano 50.000 Cr$	Caracterização de envoltória de resistêncio ao cisalhamento através de ensaios triaxiais.		
Compressão em fragmentos irregulares	IPT	1 ano 50.000 Cr$	Determinação da resistência à compressão de rochas		
Estudo do comportamento das fundações da eclusa da Usina de Promissão	CESP	6 mêses 60.000 Cr$	Estudo teórico, através dos elementos – finitos, do comportamento das fundações da eclusa da Usina de Promissão com o enchimento de reservatório		

continue

Title of Project	Sponsor	Time and Costs Budgeted	Character of Work	Routine Work	Trouble Shooting
Estudo geotécnico e tratamento de fundações de barragens	FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo) e ACTIM (Agence pour le Coopération Technique Industrielle et Economique, France)	9 mêses 5.948 US $	Estágio em diversas entidades francesas ligadas à Geologia Aplicada		
Previsão de Alterabilidade de Rochas	CESP	2-3 anos 60.000 Cr$	Pesquisa experimental procurando aplicar our aperfeiçoar e desenvolver técnicas ou métodos de previsão de degradação em rochas, especialmente em rochas basálticas	Identificação e descrição de minerais e rochas; testes mecanicos de rochas	Armazenamento de rochas, condições ambientais para equipamento especiais, logistica (informação, tempo etc.)
Degradação de Basaltos da Barragem de Capivara	CESP	2 anos 30.000 Cr$	Pesquisa aplicada ao estudo de basaltos de Capivara de acôrdo com suas caracteristicas e durabilidade	Identificação e descrição de minerais e rochas; testes mecanicos de rochas	Armazenamento de rochas, condições ambientais para equipamento especiais, logistica (informação, tempo, etc.)
Zoneamento de Corpos basalticos	IPT	1 ano 20.000 Cr$	Estudo de variações verticais de propriedades tecnológicas petrográficas de corpos basalticos dos grandes derrames toleíticos da Bacia do Paraná	Identificação e descrição de minerais e rochas; testes mecanicos de rochas	Armazenamento de rochas, condiçoes ambientais para equipamento especiais, logistica (informação, tempo, etc.)
Técnicas e métodos da quantificação de minerais (1 - minerais de argila em basal-	IPT	2-3 anos 100.000 Cr$	Aplicação, testes e talvez aperfeiçoamento de técnicas de quantificação de minerais	Identificação e descrição de minerais e rochas; testes mecanicos de rochas	Armazenamento de rochas, condições ambientais para equipamento especiais logistica (invormação, tempo, etc.)

continue

Title of Project	Sponsor	Time and Costs Budgeted	Character of Work	Routine Work	Trouble Shooting
Propriedades Abrasivas de rochas e minerais	Construções e Comércio Camargo Correa S/A	2 anos 140.000 Cr$	Determinação da resistência ao desgaste de abrasivos naturais, o papel dos abrasivos naturais em ligas metalicas, desenvolvimento		
Ensaios com esclerômetros de Schmidt em rochas	IPT	1 ano 40.000 Cr$	Determinação de valores de dureza esclerométrica em rochas empregadas em materiais de fundação e discussão de sua aplicabilidade em Trabalhos de rotina.		
Resistência ao desgaste a umido como uma propriedade indice de rochas	IPT	6 mêses 50.000 Cr$	Aplicação do equipamento de "Slake durability" apresentado no 2º. Congresso da Sociedade Internacional de Mecânica de Rochas"		
Determinação da Tenacidade de rochas em corpos de prova regulares	IPT	6 meses 50.000 Cr$	Estudo para aplicação em trabalho de rotina		
Projeto do rio Jubones (Equador)	CNEC	1 ano 18.000 Cr$	Estudos geofisicos (elétrico e sismico) em Cerritos, Minas, Ushcurrumi, Caloguru, Santo Agostin e San Francisco (Equador)	Emprêgo de refração e do método de eletro resistividade	
"Sistema Cantareira" - Tunel de ligação dos rios Cachoeira - Atibainha	COMASP	1 ano 17.000 Cr$	Ensaios micros sísmicos dos rios Cachoeira Atibainha (tunel "6" do Sistema Cantareira), situado no municipio de Piracaia - SP, afim de obter dados necessários aos estudos de definição do revestimento do tunel	Utilizou-se equipamento de refração de 12 canais RS-4 da SIE	

continue

Title of Project	Sponsor	Time and Costs Budgeted	Character of Work	Routine Work	Trouble Shooting
"Sistema Cantareira" – Tunel de ligação dos rios	COMASP	1 ano 20.000 Cr$	Ensaios microssísmicos no túnel de ligação dos rios Atibainha – Juqueri (tunel 5 do Sistema Cantareira), situado no município de Nazaré Paulista (SP) com a finalidade de obter dados necessários – ao dimensionamento do revestimento do tunel	Levantamento sísmico em um trecho com 400 m de extensão. Foi utilizado o equipamento de refração de 12 canais RS–4 da SIE	
Relocação da Rodovia Nazaré – Guarulhos	COMASP	15 dias 20.000 Cr$	Ensaios eletro–sísmicos em um trecho novo da rodovia Nazaré – Guarulhos	Utilizou–se o equipamento de refração RS–4 de 12 canis da SIE e o equipamento da resistividade R–50 da SOIL–TEST	
Calibração dos Geofones pertencentes ao equipamento de refração RS–4	IPT	1 mês 1.000 Cr$	Calibração dos geofones do RS–4		
Estudos para a localização das áreas de emboque e desemboque de um túnel a ser construido no sistema Cantareira	COMASP	20 dias 20.000 Cr$	Estudos para a localização das áreas de emboque e desemboque de um túnel a ser construido	Foi usado o equipamento de refração "RS–4" – da SIE 12 canais, e o equipamento de resistividade "R–50" da SOIL–TEST	

Appendix 22

ORE TREATMENT

Graduate Personnel

Name and Title	Branch of Science	Specialization	Years with IPT
Carlos Dias Brosch Mining Engineer and Metallurgist	Extractive Metallurgy	Processing of metallic minerals	20
Victor A.M. Lo Ré Chemist	Metallurgy		27
Cláudio Tort Navarra Chemist	Spectrography		10
Arthur Pinto Chaves Metallurgical Engineer	Metallurgy	Petrography of Coals treatment of granular materials and beneficating of minerals	2
Antonio Carlos Jambeiro de Oliveira Metallurgical Engineer	Metallurgy	Beneficiating of minerals; Carbonization and distillation of coals; Sinterization of iron minerals; Metallurgical Reactions	1
Silvio Benedicto Alvarinho Metallurgical Engineer	Metallurgy	Treatment of minerals Reduction	1
Ruy Guilherme de Lima Machado Metallurgy	Metallurgy		1

Inventory List of the Division

Fôrno de calcinação aquecido a globar para temperaturas até 1200°C

Mufla para calcinação de mostras até 1000°C

Misturador tipo Simpson (Fungel) com capacidade até 5 kg

Misturador de tambor de 600 mm de diâmetro

Potenciometro e variac para contrôle de temperatura dos fôrnos, 110 V para 12 KVA, de 10 em 10 volts

Um jôgo de peneiras série Tyler

Balança romana com capacidade até 3 000 gr

Estufa para secagem de amostras

Agitador de misturas motorizado (1/4 HP).

Vibrador

Balança Filizola capacidade 500 kg

Fluidizador "Siboral"

Compressor Waine

Caixa para condensação dos gases de sinterização com chuveiro

Desintegrador tipo mDR-4-Mn. - Máquinas Renard - S. Paulo

Moinho de Bolas - Máquinas Renard - São Paulo

Elevadores de canecas tipo "ECC-125x80" - Máquinas Renard - São Paulo

Dessecador

Balança de 1 prato (Sartorius) cap. 1 000 g

Balança Sartorius (cap. 50 g)

Chave magnética ERIEZ

SPEEDY Moisture tester dietert no. 288

Almofariz de ágata - Casa da Química Sociedade Ltda

Pignômetro de ar Bechman

Valvula de expansão termostática Dantoss (tipo TUJ)

Tubos de ensaio

Erleymeir

Balões volumétricos

Cápsulas de porcelana

Fôrno de calcinação quecido a globar para temperatura de 900°C

Disco pelotizador de 600 mm de diâmetro

Instalação para sinterização, provida de medidores de vazão e termo-pares. Provido de caixas de 10 cm de diâmetro (cilindrico) e de 30 cm (prismático).

Variac para contrôle de temperatura dos fôrnos, 110 V para 6 KVA, de 10 em 10 volts.

Um jôgo de peneiras série Tyler

Balança de pratos suspensos até 500 gr

Filtro para proteção da bomba a vácuo (Construído no IPT)

Fôrno Mace

Maçarico para queima de xistros (Fabricado no IPT)

Fluidizador miniatura (Construído no IPT)

Aparelho para ensaio de cominuição

Betoneira para misturas e pelotizações

Silos - Máquinas Renard - São Paulo

Alimentador automático - Máquinas Renard - São Paulo

Selector de Pó - Máquinas Renard - São Paulo

Permeâmetro de Blaine

Microscópio polarizante (Leitz) no. 343719 - 3 objectivas e ? oculares

Balança (cap. 1 000 g)

Milivoltímetros ENGRO para medida de termoelementos

Vibrador pequeno (Produtest)

Almofariz de ferro

Aparelhos de mola helecoidal para ensaio de resistência à compressão com escala de 1 e 10 kg

Medidores de pressão

Cilindors graduados de vidro

Copos

Funis

Cadinhos de porcelana

Appendix 23/2
ORE TREATMENT

Mineroteca com aproximadamente 150 amostras de minérios

Peneiras com abertura das malhas- 2,50 mm e 600 mm de diâmetro (Feijão)

Termômetro de 0 - 100°C

Balança com capacidade de 200 g

Densímetros 0,30

Termômetros de 360°C

Tesoura

Maçarico de laboratório com tripé - Química Moderna Com.Imp. - SP

Estufa elétrica, p/temperatura ambiente até 110°C - Fanem Ltda. - São Paulo

Quarteador de amostras p/ 1" - Solotest Aparelhos para Mecânica do Solo Ltda. - São Paulo

Cadinho de platina - Francisco Sna José Saeta - São Paulo

Projetor fixo para slides de 35 mm - Fotoptica S.A. - São Paulo

Moto esmeril de 3/4". - Gustavo Ammermann Importadora Ltda. - São Paulo

Paquímetro de Aço Inox - Aupame Automatização e Aparelhos de Medição Ltda. - São Paulo

Máquina para cortar pequenas amostras de rochas, minérios, vidros, cerâmica e similares no. 11-1175 "Buehler" - Buehler Ltd. USA

Timer (marcador de Tempo) - Rene Graf Importação e Representações S.A. - São Paulo

Britador Denver de 8" x 10" (Eccentric Roll Crusher)

Moinho de Rolo

Células de Flutuação duplas (Denver no. 8)

Ponte Rolante DEMAG p/ 5 toneladas

Mesas de concentração, vibratórias, Denver-Wilfley no. 13-B

Aparelhos Mace de sinterização tipo 1A com pertences

Peneiras com abertura das malhas = 1,24 mm e de diâmetro 500 mm (Fubá)

Peneira malha 30

Peneira malha 160

Lupa com luz

Balança com capacidade de 10 kg

Termômetros de 200°C

Pinça

Câmara de água com resistência elétrica - Química Moderna - SP

Percoladores para lixiviação bacteriana. Antonio de Carvalho - SP

Aparelho para eletroanálise (eletroanalizador) - Química Moderna Comércio e Importação Ltda. - São Paulo

Projetor cinematográfico sonoro 16 mm - Fotoptica S.A. = S.P.

Lupa estereoscópica - Fotoptica - São Paulo

Peneiras vibratórias magnéticas - Química Moderna Comércio e Importação Ltda. - São Paulo

Furadeira elétrica marca Black-Decker - Casa dos Machos Importadora Ltda. - São Paulo.

Cronômetro Liga (suiço) - Aupame Automatização e Aparelhos de Medição Ltda. - São Paulo

Prensa mecânica motorizada elétrica - Solotest Aparelhos para Mecânica de Solo Ltda. - São Paulo

Chapa elétrica dom três temperaturas - Fanem Ltda. - São Paulo

Moinho de Bolas

Moinho de Martelos

Guinchos manuais p/ 2 000 kg

Alimentadores Denver mod. 12 A para recipiente líquido

Jigs duplos Denver (Harztype)

Embassador Denver com tanque de 3' x 3'.

List of Projects completed and under way since 1-1-1970

Sinterização de Finos de Granito
Pedreiras Cantareira S.A. - Barueri
Cr$ 2.200,00
Relatório

Aglomeração de Finos de Coque
Pedreira Mairiporã S.A. - SP
Cr$ 800,00 + Cr$ 1.660,00

Ustulação da Molibdenita em Leito Fluidizado
Prometal - Produtos Metalúrgicos S.A. - SP
Cr$ 1.670,00
Reletório

Obtenção Experimental de Sinter Auto-Fundente em Aparêlho Mace
Companhia Siderúrgica da Amazônia - Amazonas
Cr$ 5.181,00
Convênio

Parecer sôbre o processo de Fabricação de Cal
Companhia Siderúrgica da Amazônia - Amazonas
Cr$ 3.195,00

Aproveitamento de Ferro Titanífero
Metail de Coiás S.A. - METAGO - Go
Cr$ 5.000,00
Relatório

Estudo de Minérios de Ferro Manganês de Mina Bupeva
Mineração Bupeva Ltda. - Joinville - SC
Cr$ 3.000,00
Projeto
Relatório

Estimativa des Custos de uma Instalação de Sinterização com Capacidade de 100/500.000 ton/ano
Cia. Siderúrgica J.L. Aliperti
Cr$ 3.000,00
Convênio
Relatório

Aglomeração de Finos de Carvão Vegetal
Companhia Siderúrgica J.L. Aliperti
Cr$ 5.153,00
Convênio
Relatório

Beneficiamento e Moagem de Carvões
COSIPA - SP
Convênio

Redução Direta de Minérios de Ferro Usando os Folhelhos Betuminosos como Redutor
CIRB
Cr$ 32.000,00
Convênio

Produção Experimental de Sinter de Finos de Minério de Ferro
Companhia Siderúrgica J.L. Aliperti - SP
Cr$ 30.000,00
Convênio

Utilização de Pelotas Auto-Redutoras em Fôrno Elétrico
Companhia Ferro e Aço de Vitória - Vitória
Cr$ 30.000,00
Relatório

Aproveitamento Econômico do Carvão do Paraná sob a forma de Coque e Semi-coque, incluindo ensaios de coqueificação caracterização petrográfica dos carvões, estudo de beneficiamento dos carvões, caracterização tecnológica dos carvões e produção de semi-coque em fôrno de grelha.
Cr$ 5.000,00
Relatório

Estudo do Comportamento na Sinterização de Finos de Minério de Ferro - Finos Comuns de 1/2"1 Sinter Feed A, Sinter Feed Piçarrão, Sinter Feed 50 % A + 50 % B e Sinter Feed 75 % A + 24 % B
Companhia Vale do Rio Doce
Cr$ 22.200,00
Relatório

"Influência da Variação de Temperatura sôbre os Diagramas de Estado Sólido-Gás"
Autor: Arthur Pinto Chaves.
(Vide anexo - item 16).

Graduate Personnel

Name and Title	Branch of Science	Specialization	Years with IPT
Edgar Ghilardi B.S. in Agricultural Engineering	Agricultural	Forestry, Wood	24
Paul Philipp B.S.	Chemistry	Basic and Applied Technology – Pulp and Paper	2,5
Marcio Augusto Rabelo Nahuz B.S.	Forest Engineering	Forest Inventory, Economics and Statistics	3
Calvino Mainieri B.S. in Agricultural Engineering	Agricultural	Botany – Wood Anatomy	33
Benedicto Leonardo Primo B.S.	Agricultural Engineer	Botany – Wood Anatomy	28
João Peres Chimelo B.S.	Agricultural Engineer	Botany – Wood Anatomy	4
Amantion R mos de Freitas B.S. in Civil Engineering M.S. in Forestry	Civil Engineering	Wood Preservation	8
Ennio Silva Lepaga B.S.	Chemical Engineering	Wood Preservation	4
Lauro Watanabe B.S.	Forestry	Wood Preservation	1
Elson Ramos Junior B.S.	Forestry	Wood Preservation	0,5
Kenshi Hayashida B.S.	Forestry	Wood Panel Products Graduate Studies at the Government Forest Experiment Station, Meguro, Japan	5
Luis T. Watai B.S.	Chemistry	Wood Panel Products	1
Anibal Bartz	Forestry	Timber Physics; Graduate studies at the Institute for Wood Physics, Hamburg, Germany	3

Appendix 25/2
WOOD DIVISION

continue

Name and Title	Branch of Science	Specialization	Years with IPT
Arcanjo Yamamoto B.S.	Forestry	Wood Drying	0,5
Beatriz Vera Pozzi Redko B.S.	Chemical Engineering	Applied Chemistry - Pulp and Paper Technology	10
Rosely Maria Viegas Assumpção B.S.	Chemical Engineering	Basic and Applied Technology - Wood Extractives	8
Marcos Teixeira de Freitas B.S.	Chemical Engineering	Applied Chemistry	2
Sandra de Freitas Fernandes Pontes B.S.	Chemical Engineering	Applied Chemistry - Pulp and Paper Technolgy	1
Flávio Giolito Morsoletto B.S.	Chemical Engineering	Applied Chemistry - Pulp and Paper Technology	1
Maria Celina Santana B.S.	Chemical Engineering	Basic and Applied Technology - Wood Extractives	3
Silvia Bugajer B.S.	Chemical Engineering	Applied Chemistry - Pulp and Paper Technology	1

Equipment Available and Ordered

WOOD DIVISION

Cassette Recorder KT-290 - TOSHIBA from Tokyo Shibaura Electric Co. Ltd. 1971
Slide Projector Auto-Cabin - TOSHIBA 1971
Overhead Projector for clear pictures 3M Band - 1971
Monroe electronic programmable printing Calculator, EPIC 3000 Monroe International, Inc. Orange, New Jersey - 1971

Forest Inventory Group

Haga
Sutas
Spiegel relaskopes
B.A.I.

Tapes
Clinometers
Compasses
Parallax bar

Stereoscope
Chain saw
Design equipment

Wood Anatomy Group

1 microtime Jung Model K (1930)
1 microtome Reichert (1966)
1 Photomicroscope Zeiss II (1970)
1 microscope Leitz (1966)
1 Stereomicroscope Zeiss (1970)
1 Photomicroscope Leitz (1945)
1 complement for polarized light

1 microtome Jung Model K (1966)
1 sharpening machine for microtome blades (IPT - 1969)
1 microscope Zeiss (1965)
1 microscope Leitz (1950)
1 Stereomicroscope Leitz (1966)
1 complement for phase contrast

Wood Utilization Group

Inoculation Room
Incubation Room
Controlled temperature and humidity room
Chemical analysis laboratory
Wood preservation pilot plant
Experimental dry-kiln
Horizontal band-saw
Corpenter shop for preparation of samples

Mohr & Federhaff 10 t press
Amsler 4 t press
Micrometers, dynamometers, calibers, etc.
18 - channel electronic recorder
Strain gauges, thermo-couples, hygro sensors, etc.
1,5 t hand winch
Electronic programmable printer calculator

Wood Chemistry Group

Pulp and Paper Laboratory

For pulping wood and celulosic materials:

Two digester 20 liters capacity - REGMED - Fabrication 1960 and 154 - Model AUE
One Bauer Refinger REGMED - Modell 300 - Fabrication 1955
Two Hollander Beaters, for Laboratory, Voith, model 3188 and 3187 - Fabrication 1955
One Jakro mill - REGMED - 1961
One Hydrapulper, 50 liters capacity Voith - Fabrication 1965
One Cleaner, Voith 1955
Two mixers, Regmed, 1961

Three ovens, Fanem, 1968
Two water baths, Fanem, 1970
One muffle, Shinohara Electric Instruments, 1970
Two balances
Two vacuum pumps
One small destilator
One mixer
Jne Phmeter Beck, 1967
One Magnetic stirrer, A. Thomas, 1969
Two Soxhlet extractors
One SCAN Viscosimeter
One Schopper Riegler, Freeness, REGMED 1961

Laboratory glasses

For Paper Testing:

One dinamometer, REGMED, 1968
One Elmendorf tester, Twing Albert Instruments Co. 1960
One Mullen tester, REGMED, 1964
One Stifness tester, Karl Frank, 1969
Two folding testers, Schopper, 1955
One folding tester, model Kolher Mollin, REGMED, 1966
Two densometers Gurley, REGMED, 1965
One reflectometer, ELREPHO, 1966
One crush tester, REGMED, 1967
One Concora medium fluter, Karl Frank, 1969
One glossmeter Hunterlab, 1969
One Cobb tester IPT
One room with controlled temperature and humidity
One basic weight Scale - REGMED - 1968
One immersion cooler for laboratory
One constant temperature bath
One freezer
One Blue M - Air - cooled relative humidity cabinet
One puncture tester, Karl Frank

Wood Extractives Laboratory

For Identification and Fraccionation of Extractives:

Densicord Photovolt - A. Thomas, 1969
Equipment for paper - Chromatography 1968
1 oven Fabbe - 1969
1 oven Fanem - 1970
6 electric baloon heaters for 1000 ml
1 vacuum pump Leybold
Destilation apparatus
Water bath Fanem - 19
Centrifuge Luferco - 1969
1 Mettler Balance
1 Laboratory Mill MR-O/M - Máquinas Renard - 1969
Rosin and Turpentine - Pilot plant
Color comparator - Hellige
Totative evaporator Buchler - Cole Palmer Instrument Co.
1 Pyrometer and Termo couple - Electrical Instruments Eng.

Pulp and Paper Laboratory

For Pulping:

One balance
One Chopper Riegler freeness
Laboratory sheet mold, model Williams

For Paper Testing:

One Elmendorf tester, Twing Albert Instruments Co.
One stiffness Taber, IMI

Graphic Arts Laboratory

For Paper and Ink Testing:

One IGT, model A-2 - Printability Tester

Ordered for the Wood Extractives Laboratory:

Muffle - 0-1200°C - Forlabo
Equipment for gas chromatography

Projects Completed and under way since 1-1-1971

Subject	Sponsor	Time	Costs
Forest Inventory Group			
Forest Inventory of the Basis of Tapajós, Xingu, Madeira and Tocantins, 1.st phase	ECOTEC - SUDAM	1 year	6,000,000.- Cr$
Further 6 projects	IPT		10,000.- Cr$
and others			8,200.- Cr$
Wood Anatomy Group			
Brazilian Woods with Riple Marks	IPT	1 year	21,900.- Cr$
Additives for oil-type preservatives	IPT-FAPESP	3 years	21,700.- Cr$
Installation of fence test plots for preservative evaluation	IPT-S.P. Forest Inst.	3 years	10,000.- Cr$
Contribution to the standardization of tests of plywood, fiber and particle board	IPT	2 years	17,000.- Cr$
Low temperature curing adhesives for wood	IPT-FAPESP	2 years	52,000.- Cr$
Resin impregnated paper overlay for wood-based boards	IPT-FAPESP	1 year	30,400.- Cr$
Plywood manufacture using Pinus sp. wood	IPT	8 months	21,400.- Cr$
Dynamic loading of wooden crossties	IPT-EFS	2 years	35,000.- Cr$
Application of X-ray spectrometry in the analysis of preserved wood	IPT-FAPESP	1 year	13,000.- Cr$
Preservative for treating logs in the forest	IPT-Clorogil S.A.	6 months	13,000.- Cr$
Cross-tie quality control treatment	IPT-CVRD	1 year	90,000.- Cr$
Experimental integrated sawmill, plywood-particle board plant	IPT-BID	3 years	254,000.- Cr$
Further 7 projects	IPT		27,300.- Cr$
and others			24,100.- Cr$

continue

Subject	Sponsor	Time	Costs
Wood Chemistry Group			
Pulping of Sisal	Ariano Araujo Engenharia e Montagens São Paulo	4 months	6,000.- US $
Semichemical Pulping of Eucaliptus Saligna	IPT-BNDE-BID	2 years	30,000.- US $
Pulp from bamboo	IPT	6 months	8,000.- US $
Pulping of Brazilian Woods	IPT		24,000.- US $/year
National Papers and Boards	IPT - Associação Paulista dos Fabricates de Papel e Celulose	2 years	48,000.- US $
Chemical Studies on Lignin	IPT	1 year	6,000.- US $
Bleachibility of pulps	IPT	2 years	12,000.- US $
Corrugated Medium from Brazilian Pulps	IPT	2 years	12,000.- US $
Physical Mechanical Tests of Newsprint	O Estado de São Paulo	2 years	3,000.- US $
Physical Mechanical Tests of Paper	9 sponsors	2 years	5,000.- US $
Pulping of Euterpe Sp. Stems	Secretaria da Economia e Planejamento - S.P.	3 months	2,500.- US $
Expansion and Development of Research Facilities of the Pulp and Paper Section of IPT	MINIPLAN CNPQ BID	3 years	1,067,300.- US $
X-ray in Preserved Wood Analysis	IPT-FAPESP - São Paulo	2 years	4,000.- US $
Pirolysis of Woods	IPT	10 months	2,600.- US $
Further 1 project	IPT		1,250.- US $
and others			10,000.- US $

Appendix 28/1
CHEMISTRY DIVISION

Graduate Personnel

Name and Title	Branch of Science	Specialization	Years with IPT
Sylvia Lourdes Moro Chemist	Chemistry	Analytical Chemicstry	10
Tsai Soi Mui Lee Chemist	Chemisty	Analytical Chemistry	2
Noriko Takahashi Chemist	Chemistry	Analytical Chemistry	1
Francisco Di Giorgi Chemist	Chemistry	Analytical Chemistry	6
Luiza Satiko Onozaki Chemist	Chemistry	Analytical Chemistry	2
Nedir Oorta S. Pereira Chemical Engineer	Chemistry	Analytical Chemistry	2
Miriam Ashino Chemist	Chemistry	Analytical Chemistry	1
Luiza Oide Wiikmann Chemical Engineer	Chemistry	Analytical Chemistry	1
José Luiz Alves de Mello MA Chemistry	Chemistry	Industrial Water	32
Roberta Bastianelli MA Chemistry	Chemistry	Instrumental Analysis	4
Cherry Yumiko Sagae Pharmacist and Biochemist	Pharmacy and Biochemistry	Instrumental Analysis	2
Sonia Lôbo Ielo MA Chesmistry	Chemistry	Instrumental Analysis	1
Venâncio Ferreira Alves Industrial Chemist	Chemistry	Chemical Analysis of metals - preparation of patterns for laboratory	31
Tokio Morita BS, MS		Organic synthesis, essential oils, petroleum derivates and petrochemicals	11

Appendix 28/2

CHEMISTRY DIVISION

continue

Name and Title	Branch of Science	Specialization	Years with IPT
Arline Sydneia Abel B.S. Chemistry	Chemistry	Oil and fats (transesterification of oils)	2
Cleide Bassani Pharmaceutical-biochemist		Essential oils (Eucalyptus oil)	2
Valdai Ide Pharmaceutical-biochemist		Oils and fats (vegetal oil)	2,5
Yokichi Murai BS of Agricultural chemistry		Petroleum products (analysis)	2
Kenji Takemoto Industrial chemist		Petroleum products (analysis	1
Vasco dos Santos Dias Engineer	Chemistry	Tecnologia de Borracha	4
Hiroshi Kuribara Engineer	Chemistry	Plastics	3
Godofredo Winnischhofer Chemist	Chemistry	Dyes (Forschungsinstitut für Pigmente und Lacke, Deutschland	7
José C. Olivieri Chemist	Chemistry	Dyes	3
Wolfgang Kolbe Industrial chemist	Chemistry		13
Francisco Mattos Mazzei BS of Chemistry	Chemistry		25
João R. Pucci Industrial chemist	Chemistry	Chemical Analysis and Technology	39
Isabel M. Geve Engineer	Chemical Engineering		4
Massakazu Outa Engineer	Chemistry	Tecnologia da Borracha no National, College of Rubber Technology, London	23

Appendix 29/1
CHEMISTRY DIVISION

List of Equipment Installed and Ordered

Organic Analysis Section

Spinning band distillator Nester Faust Manufacturing Corp. 1969
Polarimeter, Atago Co., Ltd., 1970
Thin layer chromatograph, Permution Co., 1971
Automatic agitator, Warner Chilcott Lab., 1969
Density balance (Westphal type) Christian Becker Inc. 1950
Refractometer, Precision Scientific Co., 1969
Essential oil distillation apparatus, 1971
Melting point determination apparatus, Thomas & Co., 1971

Oils and Fats Section

Moisture balance, Cienco Co., 1971
Chromato vue Ultra-violet a apparatus, Ultra-violet Products, Inc., 1971
Potentiometer, Metrohm, 1971
Lovibond colorimeter, Lovibond, 1969

Petroleum Derivative Section

Saybolt viscometer, Precision Scientific Co., 1970
Carbon-Hydrogen analyer, Coleman Instruments Co., 1967
"Pensky-Martens" Flash point determination apparatus, Precision Scientific Co., 1971
Koehler automatic aniline point determination apparatus Koehler Instruments Co., Inc., 1969
Low temperature Kinematic viscosity bath, Precision Scientific Co., 1967
"REID" vapor pressure determination apparatus Precision Scientific Co., 1971
Gum contents of gasoline apparatus, Precision Scientific Co., 1970
"Tag" Flash point determination apparatus Precision Scientific Co., 1971
"Cleaveland" Flash point determination apparatus Precision Scientific Co., 1971
Fischer ASTM colorimeter, Fischer Scientific Co., 1968
Demulsibility apparatus, Precision Scientific, Co., 1969
Falling ball viscometer, Polyscience Corp., 1968
Kinematic viscosity bath, Precision Scientific, Co., 1970
"UNION" colorimeter, C.J. Tagliabue MFG Co., 1965
Universal penetrometer, Precision Scientific Co., 1960

Instrumental Analyse Group

Instrumento - Karl Fischer, 2 anos
Instrumento - Ponte de condutância, 5 anos
Instrumento - Espectrômetro de infravermelho Perkin-Elmer 237, 10 anos
Instrumento - Polarógrafo - Metrohn, 1 ano
Instrumento - Potenciômetro PS 2 anos
Instrumento - Espectrofotômetro na faixa visível e ultravioleta - HILGER, 2 anos
Instrumento - Cromatógrafo de Gás - Perkin-Elmer 154, 10 anos

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2 cátodos de mercúrio Eberbach, 1966
1 contador de radiações Phillips, 1961
1 microscópio Cycloptic 1969
1 turlidímetro Hellige, 1970
1 fotômetro Micronal, 1970
1 aparêlho para determinação de carbono, Lindberg, 1962
Máquina fotográfica para microscópio estereoscópico mod. PM-6 Olympus, 1 ano
Aplicador centrífugo mod. 334/II Erichsen, 1 ano
Centrífuga IEC International, 2 anos
1 colorímetro foto-elétrico Klett-Sommersou, 1969
2 fotômetros de chama Coleman, 1961 e 1966
1 aparêlho de absorção atômica Varian 1971
3 aparêlhos para eletrólise Eberbach, 1964
1 aparêlho para determinação de enxôfre e carbono Strochlein, 1971
Microscópio esteroscópico mod. X-Tr Olympus, 1 ano
Durômetro König mod. 299 Erichsen, 1 ano
Leptoskop mod. SMG-8 Karl Deutsch, 1971
Medidor de secatividade mod. 338 Erichsen 1 ano
Viscosímetro Stormer Arthur H. Thomas, 16 anos

Appendix 29/2

Chemistry DIVISION

Viscosimetro Ford no.4 Omicron, 1 ano
Mandril cilindrico mod. 266 Erichsen, 1971
Criptômetro de Pfund Erichsen, 1971
Aparêlho de impacto mod. 304 Erichsen, 1971
Aparêlho de SO_2 mod. 330 Erichsen
Aparêlho de aderência mod. 413 Erichsen
Aparêlho Kempf mod. 241 Erichsen
Prensa a vapor, 25 anos
Extrusora para borracha, 25 anos
Dinamômetro Hamsller, 15 anos
Viscosímetro Mooney, 3 anos
Estufa de oxigênio para envelhecimento de borracha, 25 anos
Pêndulo Good-year (ensaio de resiliência) 25 anos
Flexómetro Goodrich, 25 anos
Flexômetro De Mattia, 25 anos
Misturador Eigma, para adesivos, 25 anos
Bomba hidráulica para ensaio de tubos e mangueiras, 25 anos
Dinamômetro até 10 kgf Zwick, 2 anos
Dinamômetro mod. IP-2 Henry Scott Co., 32 anos
Formador de meadas tipo guarda-chuva Goodbrand & Co., 32 anos
Balança de torsão Louis Schopper, 32 anos
Chromato-Vue - Ultravioleta Ultraviolet Products Inc., 2 anos
Balança analítica Mettler até 160 g E. Mettler, 2 anos

Aparelho de névoa salina mod. 351 Erichsen, 1971
Mandril cônico mod. 312 Erichsen, 1971
Medidor de finura Erichsen, 1971
Aparêlho de intemperismo acelerado mod. BW-DMT Atlas Electric Devices Co. - 33 anos
Aparêlho Sward mod. 240 Erichsen
Misturador de cilindros, para borracha, 25 anos
Autoclave a vapor, 25 anos
Dinamômetro Scott, 25 anos
Dinamômetro Bendix, 1 ano
Estufa de ar para envelhecimento de borracha, 15 anos
Estufa de ozônio para envelhecimento de borracha, 2 anos
Pêndulo Zwick (ensaio de impacto), 5 anos
Aparêlho de abrasão, 25 anos
Flexômetro Scott, 25 anos
Máquina de ensaio de fadiga para mangueiras de freio, 10 anos
Gerador de vapor, 8 anos
Dinamômetra até 250 kgf Louis Schopper, 32 anos
Abrasímetro Louis Schopper, 32 anos
Torsímetro manual Henry Scott Co., 32 anos
Aspa Goodbrand & Co., 32 anos
Micrômetro Louis Schopper, 32 anos
Seriplano Goodbrand & Co., 32 anos
Microscópio binocular mod. Standard Universal Carl Zeiss, 2 anos

1 Regularímetro Uster tipo B
1 Integrador Eletrônico Uster
1 Indicador de Imperfeições Uster

2 Registradores Uster
1 Espectógrafo Auromático Uster

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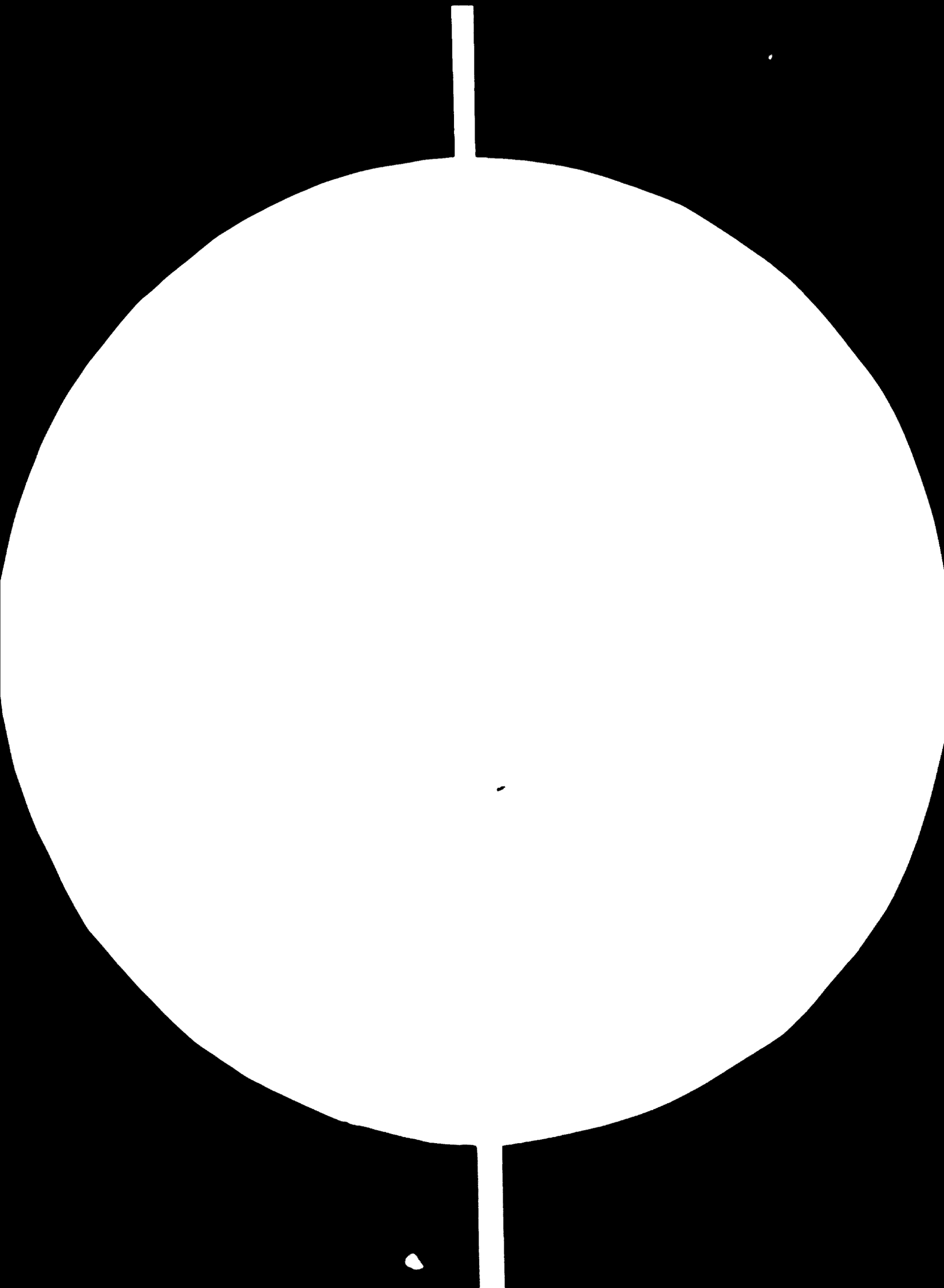

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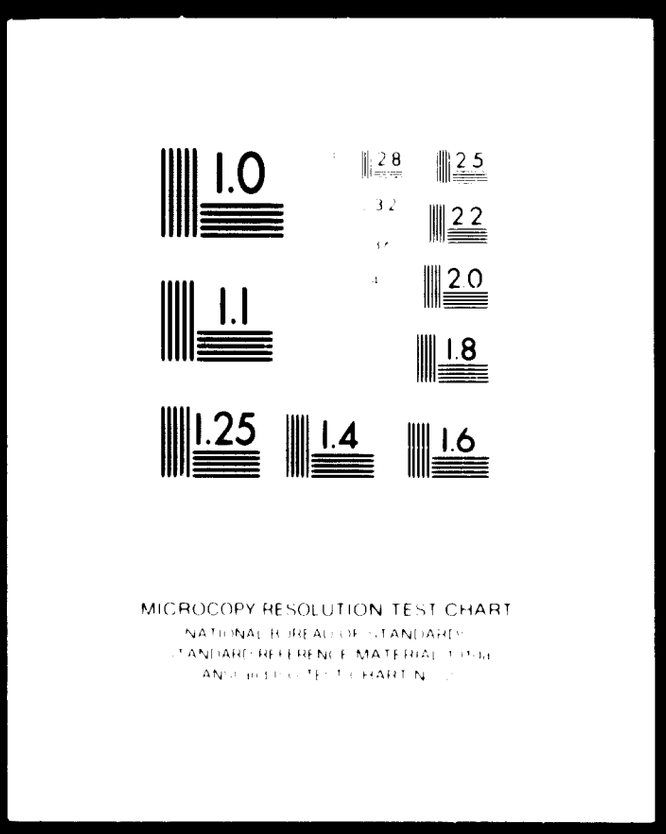
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QUESTIONNAIRE

Please Return this Questionnaire as soon as Possible

1) Title of division?

2) Name and title of division head?

3) Number of persons employed?

4) Organisational structure of the division?

5) Employees broken down by professional background for each organisational unit.

   graduated

   full skilled

   auxiliary

   administrative

6) Please list names and titles of graduated personnel as follows:

   Name

   Title

   Branch of science

   Specialised in which field

   What post graduate studies abroad

   With IPT since how many years

7) Please list projects completed and underway since 1970, 1st of January

   Title of project

   Sponsor (name and location)

   Time and costs budgeted

   Specify character of work

   - Trouble shooting
   - Contracts
   - Convenios and own research

8) Please name the important special fields of activity in each section and describe in short applied operational methods.

9) Please make up a list of the equipment at present at your disposal and already ordered (name of model, purpose, manufacturer, year of fabrication).

10) Which equipment necessary to improve your work do you miss?

11) Criticise the physical facilities of your divisions:

size of building

laboratories

administration

fabrication

machine shops

stores

maintenance

documentation

12) Which development of your division do you plan for the next years up to 1975 (please attach a copy of your written plans if any)

13) Please give estimation of future requirements in your research field of industry and government

14) Please describe in short industrial connections and relationship with

private industry

public industrial establishments

governmental agencies and corporations

foreign joint ventures

professional associations

15) Please describe in short connections and relationship with

- libraries
- information and documentation services
- academic community
- other institutes working in the same field, national and international

16) Please list all publications and brochures in which your division or your research results are presented (since - 1/1/1970), if possible attach copies.

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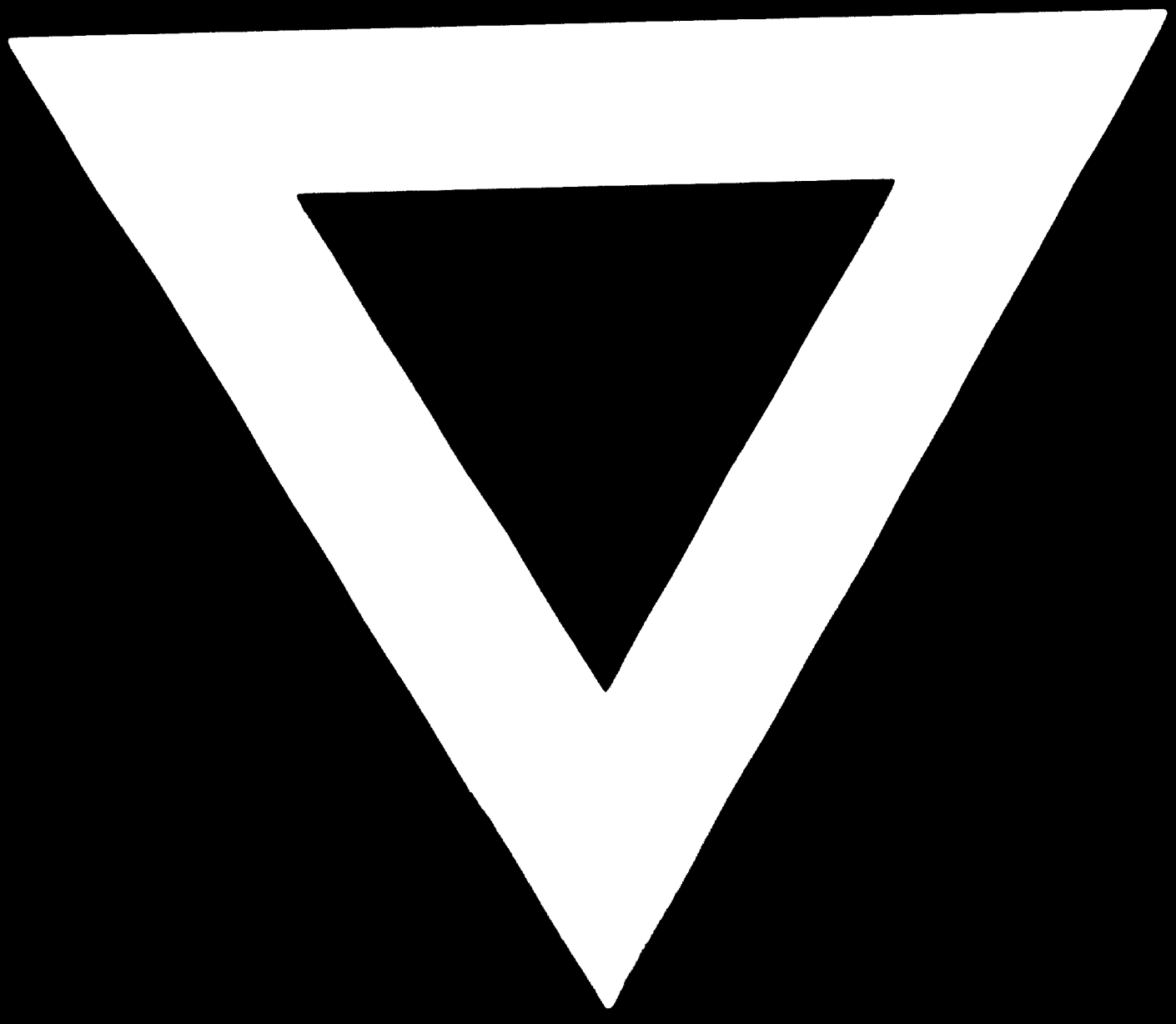

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