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CONSOLIDATION OF CAPACITY OF INSTITUTE OF FOOD TECHNOLOGY THROUGH CREATION OF A NATIONAL FOOD PACKAGING CENTRE

DP/BRA/82/030

BRAZIL

Technical report: Consultancy on glass packaging*

Prepared for the Government of Brazil
by the United Nations Industrial Development Organization
acting as executing agency for the
United Nations Development Programme

Based on the work of Hendrikus de Waal
Expert in food packaging material - glass

United Nations Industrial Development Organization
Vienna

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ABSTRACT

The expert paid his second visit to CETEA/ITAL from june 9 until july 8, 1986. His senior counterparts were Mr. Luis Fernando Ceribelli Madi, Mr. Sylvio Alves Ortiz and Mr. Roberto Lopes Xavier.

Round table discussions were organized with ITAL personnel, involved in glass packaging, covering subjects like statistics for quality control, performance tests and properties of glass containers.

A one-day seminar was organized at ITAL, with attendants from the glass-,food and beverage industry.

The expert presented two papers, one on failure causes and one on new surface treatments of glass containers.

Visits were made to a large beer- and soft drink company and to a producer of food jars and pharmaceutical glass.

Discussions with representatives from glass container industries and bottling companies were also held during the IVth Brazilian Packaging Congress in São Paulo and especially during a meeting organized by CETEA/ITAL and ATBIAV, the technical glass association in Brazil, where the function of the packaging centre of ITAL was emphasized and it was shown how industry could benefit most from its existence. The reactions from industry were encouraging.

Current and recent projects, carried out by the glass section of CETEA were discussed in detail, including evaluation and presentation of results.

Future projects were scheduled, especially on closure systems, on surface treatment and on impact test methods and impact strength of glass containers.

During a visit to São Carlos University, the cooperation in these projects with the glass and ceramics department, supervised by Prof. Zanotto, was planned in detail.

In conclusion, it is the expert's opinion, that the existence of the packaging center is highly beneficial for Brazil's economy.

The packaging industry is of extreme importance for the further development of the country. It is growing fast and there are many new developments that need studying before and after market introduction. Increase in filling line speed and the use of more sophisticated handling and closure systems ask for high quality packaging and the existence of a packaging center like CETEA is essential to keep up with these developments.

Ties with industry should be strenghened, for which it seems essential that the packaging center is able to take a neutral, independent stand between government and industry, preferably supported by both sides. To realize this, further UNIDO - support would be highly beneficial.

INTRODUCTION

A. Project Background

The Institute located in the city of Campinas started the activities as a "Laboratory of Technology" on January 27 1963, with the inauguration of the new facilities.

On December 18 1964, it was established as the "Tropical Center of Research on Food Technology", as a result of an agreement signed between the Brazilian Government and the United Nations Development Programme the executors being the Government of the State of São Paulo (Secretariat of Agriculture), representing the Brazilian Government, and the Food and Agriculture Organization (FAO), representing the UNDP.

On July 14 1949, the "Tropical Center of Research on Food Technology" became the "Institute of Food Technology-ITAL", coordinated by CPA (Coordination of Agricultural and Animal Husbandry Research) of the Secretariat of Agriculture of the State of São Paulo.

Up until 1969, ITAL dealt with the technology of products of vegetable origin, but from that year on the research was gradually extended to products of animal origin, namely dairy, meat and fish. A dairy pilot plant was put into operation in 1974, followed by the meat and derivatives pilot plant in 1976, both in Campinas. Finally, a pilot plant for fish and marine products was set up in 1978, in the city of Guarujá near Santos.

The present staff of ITAL includes 13 Ph.D, 40 M.Sc., 21 graduate specialists and 27 graduates. Technical aid staff adds 52 administrative, and general supporting staff 192.

The physical installations in Campinas is represented by 23,000 square meters of buildings located in an area of 101,500 square meters, whereas in Guarujá the Institute has 8,600 square meters and a constructed area of 750 square meters.

Since the establishment in 1963, the Institute of Food Technology has acted as a leader in its field in Brazil, and is acknowledged as one of the best research Institutions in this area.

In 1965, the Tropical Center of Research on Food Technology was the first Institution in Brazil engaged in pioneer research and technical assistance to the food packaging industry. By that time, only basic quality control tests were carried out by a few packaging industries. Recently , more industries, institutions and universities are giving some contribution to this field.

The priority received by the Food Packaging Section in 1969 made ITAL the leading Institute in this particular area of activity in Brazil.

At the moment the Section comprises of four experienced M.Sc., one specialist, three graduates and three technicians. In the near future this staff will be significantly increased to face the commitments of this new project (BRA/82/030).

Packaging demand in Brazil is growing very fast, especially in the food packaging field which took 64% of the metal package, 60% of plastic, 40% of paper and corrugated and 75% of glass in 1979.

Besides the increasing consumption of packaging materials, the technological aspects are becoming more and more important today in Brazil. As a consequence of the fast rate of industrialization that the country experiences, the need for new and better packaging was hampered due to a series of problems, like the lack of know-how, information support, trained human resources, research facilities and so forth.

ITAL's packaging Section has followed the demand of the Brazilian industry in such a way that in 1982 it expanded its activities and facilities through an integrated programme to put a Food Packaging Center into operation, under the sponsorship of the Government of the State of São Paulo, the Brazilian Government (FINEP-EMBRAPA) and the United Nations Development Programme (UNDP), through the United Nations Industrial Development Organization (UNIDO). The main objective of the Food Packaging Center is to up-scale support to the packaging and food industry in Brazil and also to serve as an international training Center to assist Latin America and other countries on this technological matter.

The UN/Brazil Food Packaging Center project is identified as the project BRA/82/030, with a duration of five years, with a total of 1.512 million dollars plus Brazilian investments of 476.835 mil cruzados.

Part of the contribution in dollars is supplied by the Interamerican Development Bank cooperation programme with the Brazilian Ministry of Agriculture Agency EMBRAPA.

Basically, the project tries to optimize and make use of the food packaging nucleus already existing at the Institute of Food Technology - ITAL.

B. Objectives of the Mission

Upon arrival at the duty station, the original job description was discussed with the counterparts. It was agreed to include some round table discussions with the coworkers of the glass section on special topics and a meeting with the staff of the packaging center to discuss general items like certification, cooperation with industry and organization.

The following activities were also included:

1. Internal and external seminars for the food and glass container industry, related to mechanical properties, quality control methods and new developments in glass packaging.
2. Training of the personnel of the glass section in the equipment already available and in data evaluation.
3. Visits to industries, glass producers and users of glass packaging, in order to assess the main problems and analyse the present demand for this packaging in Brazil.
4. Analysis and orientation of present and future projects of glass packaging at CETEA/ITAL.
5. Assist the center personnel in the solution of special problems on the occasion by the food and packaging industries.
6. Prepare a final report in English regarding the activities of the mission.

RECOMMENDATIONS

1. Continue and expand glass packaging activities in CETEA/ITAL.

2. To strengthen ties with industry, make all possible efforts to ensure that the Packaging Center can take a neutral position when ever necessary.

3. Arrange to receive and install additional glass testing equipment, as recommended in Annex I of this report.

4. Arrange additional theoretical and experimental education in materials science for one of the food-engineers in the glass department at São Carlos University, UNICAMP and, if possible, at TNO in the Netherlands.

5. Continue to inform the glass and food industry about the activities of the glass packaging laboratory at CETEA/ITAL.

6. To use the Center's know-how and equipment for the glass industry, evaluate the possibility to carry out quality--certification tests.

7. To the food and beverage industry, stress the importance to carry out incoming quality control on glass containers.

8. Take on active part in official programmes on standardisation and recycling of glass containers.

9. Carry out an evaluation test programme on impact test methods and compare performance of normal and lighweight containers preferably in cooperation with São Carlos University and the glass laboratory TNO, the Netherlands.

10. Continue research on closures for glass containers, including permeability, corrosion, product shelf life, etc.

11. Prepare to carry out studies on the effect of glass inhomogeneities (cords) on strength of containers and on the effect of surface coatings on performance, incl. effect on strength, consumer safety, closure systems (torque, corrosion).

I. ACTIVITIES AND OUTPUT

A. Introduction

The present mission was the expert's second visit to CETEA/ITAL under the UNIDO programme. For that reason, much emphasis was placed upon the evaluation of current and present projects and on the scheduling of future activities.

Discussions were held with representatives from glass and food industries to obtain information on the needs and problems of the brazilian industry concerning glass packaging and to evaluate the role the packaging center could play to support industry and to increase the general quality level of packaging in the interest of the consumers. With the information obtained, a general set up could be made for the future activities of CETEA/ITAL on glass packaging, including further training , selection of additional equipment and proposals for future projects.

B. Seminars and training

Round-table discussions were organized with the personnel of the glass department on quality control, quality specifications, statistics for quality control and on mechanical, optical and chemical properties of glass containers.

An external seminar in São Paulo was organized on June 23rd with ATBIAV, the technical glass association in Brazil, where the present and future activities of CETEA in glass packaging were presented by Mr. Roberto Xavier and where the expert discussed new developments and research areas on glass containers.

Representatives on management level from all major glass companies were present at this meeting and the interest in the activities of CETEA/ITAL was most encouraging.

A one day seminar was organized at ITAL on July 2nd for the glass, food and beverage industry. The expert presented two papers here, one on reasons for failure of glass containers and one on surface treatments to increase performance of glass containers. The seminar was attended by 28 persons.

On July 1st the expert gave a presentation for the staff of the Packaging Center on the financial and technical management of the glass department at TNO, the Netherlands, including cooperation with gouvernment, industry and consumer organizations and with special reference to the parallels and differences to the Brazilian situation.

C. Visits to industry and further contacts

A visit was made to Wheaton glass company in São Paulo on June 27.

Wheaton is one of the three medium size companies in Brazilian Glass Packaging, with a nominal annual capacity of 60.000 tonnes. The company specializes in small bottles for pharmaceutical and cosmetic products, of which they have 60% of the market and also produce jars for food products. The glass is of the usual soda-lime silicate composition; designs and colours are often of a fancy character.

Compared to the situation during the expert's first mission in Brazil two years ago, the market for Wheaton's products has grown considerably and right now it is even difficult to meet demands.

This seems to be true for the glass container market in general in Brazil, which puts high responsibility on the glass producers in terms of continuing to deliver good quality containers. CETEA/ITAL should keep a close watch on this development.

On June 30 the Antarctica soft drink plant in São Paulo was visited. During the discussion with Mr. Orlando de Araujo, general manager of Antarctica's soft-drink division, it became clear that Antarctica realizes the benifits it can have from CETEA/ITAL and is open for cooperation. The management offers to make a list of topics that need study concerning glass packaging in Brazil.

The plant produces pasteurized soft drinks; incoming quality control was said to be standard procedure for the containers. The total breakage number varies between 0,35 - 0,45%, which is an acceptable level, but partly due to the relatively low filling-speed (12.000/h per filler) and the high weight/volume

ratio of the containers (1,2 for 1l bottle). In the near future filling line speeds are planned to be doubled.

On June 17 a visit was made to UFSCar (São Carlos University), where cooperation between CETEA and Prof. Dr. Edgard Zanotto of the glass and ceramics department was discussed. The shared interest of both groups in impact testing creates a good basis for cooperation. A research project was discussed in detail, which also involves participation of the gass-product section of the Institute of Applied Physics TNO, Delft, the Netherlands.

The arrival of the expert in Brazil coincided with the IVth Brazilian Packaging Congress in São Paulo. June 11 was devoted to glass packaging and the expert joined the CETEA - delegates during this day. The speakers appeared to be unanimous in their opinion that glass packaging has a solid basis and good future in Brazil. The expert had some private discussions with delegates from glass and packaging industries, among which Mr. Manuel Vieira, president of the Brazilian Packaging Association.

II. UTILIZATION OF THE RESULTS OF THE ACTIVITIES

During the two years that passed between this mission and the expert's first mission, good progress has been made.

Theoretical and experimental know-how has been strengthened by short training courses in USA , Great Britain, the Netherlands and France.

Some additional equipment was purchased and installed and valuable projects were carried out, both for industry and for government.

Glass packaging has been included in projects of a more general nature and the contacts with the glass and packaging industries have been strengthened considerably.

The glass section of the packaging centre is well on its way to become a recognized place for consultancy and technical support.

However, it is of vital importance that there remains no doubt in industry that the primary function of the center is to support and not to "control".

Even the expression "quality control" could be misleading in this respect and it is suggested to use "quality assurance" and "performance tests" instead.

The management of the center is well aware of this , but there is some doubt, whether its consequences are fully realized in all levels of the organization the center forms part of.

One of the reasons might be that ITAL has its tradition in food research and not in packaging.

Packaging research asks for a more technological, industrial approach than food research does, generally speaking and it is the expert's opinion that this rather fundamental difference has been underestimated.

One could even wonder, if the present limitation to food packaging is beneficial for CETEA.

For most producers of packaging material it is a totally artificial boundary and for CETEA the collaboration with, for instance, the pharmaceutical and cosmetic industry would enlarge the view and work area of the center considerably.

Also, a construction in which government and industry both participate in the center, financially as well as in defining activities, could be considered for the future.

To exploit and strengthen the technological know-how of the glass-packaging section of CETEA/ITAL some basic projects were defined and scheduled to be executed in the next few years. They include a detailed study on closure systems for food jars and pressurized beverages and an evaluation of impact test methods to study performance of containers.

The effect of coatings will be included in both projects, since this is to be expected as a major development in glass packaging in the near future.

A study on the effect of glass homogeneity on strength was also discussed.

Additional equipment, needed for this work, is included in Annex I of this report as "Most urgent". Other items of the list, presented in the expert's report on this first mission, that have not yet been purchased, have been included in Annex I as "Less urgent".

For further training, the expert strongly recommends courses in material science with emphasis on mechanical behaviour of brittle materials as given at UNICAMP and the Federal University of São Carlos, preferably on post-graduate level. For food engineers an introduction at undergraduate level might be necessary, as was suggested by Prof. Edgard Zanotto, of São Carlos University. The expert also recommends courses on statistics in quality control and on the use of computers for data filing and-evaluation. Since these courses, however, are more generally needed than for glass packaging it might be more efficient to organize these at CETEA for other staff members as well.

Further practical training could very well be organized at TNO, Delft, the Netherlands.

In fact, Mr. Roberto Xavier already followed a short course at TNO in 1985. To complete his education it were advisable if he could stay at the TNO - glass laboratory for an extended period of time to take active part in projects on glass packaging. In fact, the greater part of the project on impact testing, could very well be carried out in Delft, where he would have the opportunity to use the most sophisticated equipment.

ANNEX I

List of additional recommended equipment

Nº	Name	Use	Supplier	Price estimate	Remarks
	MOST URGENT				
1.	Polarisation microscope with Berek or Babinet compensator.	Exact measurement of cooling stress and inhomogeneities in glass containers	Leitz, Olympus or equivalent	Appr.$4000	Interchangeable objectives, enlargement appr. 25 - 300 times
2.	Hot end coating meter	Thickness of hot end coating on containers	AGR	$4675	Complete with coupling liquid and calibration cylinders
3.	Finish hot end coating meter	Thickness of hot end coating on the finish on jars and bottles	AGR	$3470	With coupling liquid and calibration cylinders
4.	Glass grinding and polishing table	Preparation of glass samples for microscope, optical transmission, etc.	Panambra São Paulo Type DP-9U	Equipment Cz. 23.000 Pastes appr. Cz. 10.000	Incl. felt and grinding and polishing pastes (Al_2O_3, Ceriumox. diamond)

ANNEX I - continued

Nº	Name	Use	Supplier	Price estimate	Remarks
	LESS URGENT				
5a	Strain gauge meter with strain gauges	Measurement of stress distribution in container wall during internal pressure, thermal shocks, vertical load (static test)	Peekel	Appr. $3000	Needed for design evaluation studies (does not include impact)
	or: (preferably)				
5b	Strain gauge tester with high speed strain meter, peak height meter and storage osciloscope	Measurement of stress distribution in container wall (static and dynamic test)		Appr.$15000	Like 5a, but includes impact Detailed information available at TNO, The Netherlands
6	Set of standard glasses for optical transmission	Calibration of spectrophotometer	Possibly: National Bureau of Standards Washington	Appr.$2000	Range 300-1000nm
7	Liquids for matching refractive index of glass	Quick comparison of refractive index mainly for identification of glass fragments in food	Chemical suppliers	$1000	See for details ASTM test F 128-68