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EXTENSION OF THE POLISH PACKAGING CENTRE

DP/POL/71/517

POLAND

Technical report:
**MECHANISATION OF PACKAGING
PROCESSES USING PLASTIC FILMS**

Prepared for the Government of Poland by the
United Nations Industrial Development Organisation,
executing agency for the
United Nations Development Programme



United Nations Industrial Development Organization

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Technical report: mechanization of packaging processes using plastic films

Prepared for the Government of Poland by the
United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of R. Vogt, expert in packaging

United Nations Industrial Development Organization
Vienna, 1976

Explanatory notes

The following technical abbreviations are used in this report:

EPS expanded polystyrene
PE polyethylene
PVC polyvinyl chloride
R + D research and development

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SUMMARY

The mission of the expert, as part of the parent project "Extension of the Polish Packaging Centre" (DP/POL/71/517), was to assist in mechanizing packaging processes using plastic films. The assignment was for three months from 4 July to the end of September and was preceded by a short preparatory visit. The duty station was the packaging demonstration plant at Bialystok.

The time was spent in practical work on the demonstration plant machines and in discussions of future projects including the laminating and metallizing of films. Unfortunately, the practical work was restricted by the limited supply of test materials since the Bialystok production plant was only beginning to manufacture appropriate films. It was possible to put the Illig machine into operation with improved materials. The consultant's activities also included aspects of production within his competence.

The modern development of packaging materials follows three necessary steps:

(a) Producing plastic films of the best possible quality, entailing tests with different raw materials, additives and evaluation of appropriate formulations;

(b) Measuring the required physical and chemical parameters at the laboratory;

(c) Testing the manufactured packaging materials on the packaging machines (runability of the material).

To meet these requirements the expert recommends assistance in:

(a) Obtaining equipment and auxiliary materials not at the moment produced or available in Poland;

(b) Improving the information facilities;

(c) Training the staff through special courses, seminars, meetings or exhibitions concerning the field of packaging, plastics and packaging and plastics machinery.

In addition, the expert proposes small-scale assistance from the Special Industrial Services (SIS) in the form of advice on specific problems related to phase II of the plant's production or to other topical problems.

On the basis of his observations and experience the expert suggests that the planned enlargement of the Bialystok plant (phase II) would require the close co-operation of a West European firm (e.g. 4P) which has the know-how and the technical abilities needed for such a project.

INTRODUCTION

This is the report of a mission which formed part of the larger project "Extension of the Polish Packaging Centre" (DP/POL/71/517).

The parent project was requested by the Government of Poland in November 1971 and approved by the United Nations Industrial Development Organization (UNIDO) acting as executing agency. The purpose of the project was to improve the efficiency and capacity of the Polish packaging industry to meet an increasing demand for packaging materials and to reduce the reliance of the Polish manufacturers on imports of ready-made packages.

The purpose of the expert's mission was to introduce and extend the use of the following packaging processes in Poland:

- (a) Vertical and horizontal form, fill and seal systems;
- (b) Single and multipacks in shrink films;
- (c) Packaging by thermoforming (skin pack, blister pack and similar systems).

The assignment was for three months from 4 July to the end of September 1974. The expert was attached to the State Council of Materials Economy (SCME) and was to co-operate closely with the demonstration plant at Bialystok and with the Packaging Research and Development Centre at Warsaw. As stated in the job description the expert was expected:

- (a) To appraise and advise on the selection of the packaging machines for the processes listed above;
- (b) To train staff in the operation and modification of the plant for development work;
- (c) To prepare and initiate the testing programme for the material/machine interface relationships;
- (d) To prepare technical specifications for the materials to be converted on the packaging machines;
- (e) To assess Polish-made materials with respect to the specifications and to advise on the modifications to materials or machines that would be required;
- (f) To advise on means of attaining maximum production efficiency with minimum material wastage for the processes;
- (g) To advise and train staff in the selection and measurement of the properties of materials affecting runability;
- (h) To advise generally on the criteria for the selection of packaging machines with respect to flexible plastic packaging materials made in Poland.

Description of existing plant facilities

A basic organizational scheme of the structure of the packaging demonstration plant at Bialystok is given in the figure. Only the positions important to the project are shown.

As of September 1975 the plant was producing:

- (a) PE films on 4 extruders (flat, tubular foils for bags, shrink foil);
- (b) Thermoformed PVC cups and snap-on lids;
- (c) PE bags;
- (d) Containers of expanded polystyrene (EPS).

The main equipment for the packaging systems, research and development (R + D) department are:

- (a) Rose Forgrove Flowpak 250, a machine designed for wrapping such products as bakery goods, biscuits, confectionery and tobacco in pillow-type packs;
- (b) Illig Universal Machine SB 53 b, a versatile thermoforming machine for the production of skin packs and blister packs;
- (c) Illig die-cutting roller press Z S M45, used for cutting out vacuum-formed parts from the main sheet;
- (d) Audion Elektro Vacuum Sealer 30 and Komet-Chamber machine type K3, used for the production of evacuated bags;
- (e) Polystar ST 600 of Rische and Herfurth, a shrink-wrapping machine of sleeve-wrapping type and L-sealing;
- (f) Some small sealing devices.

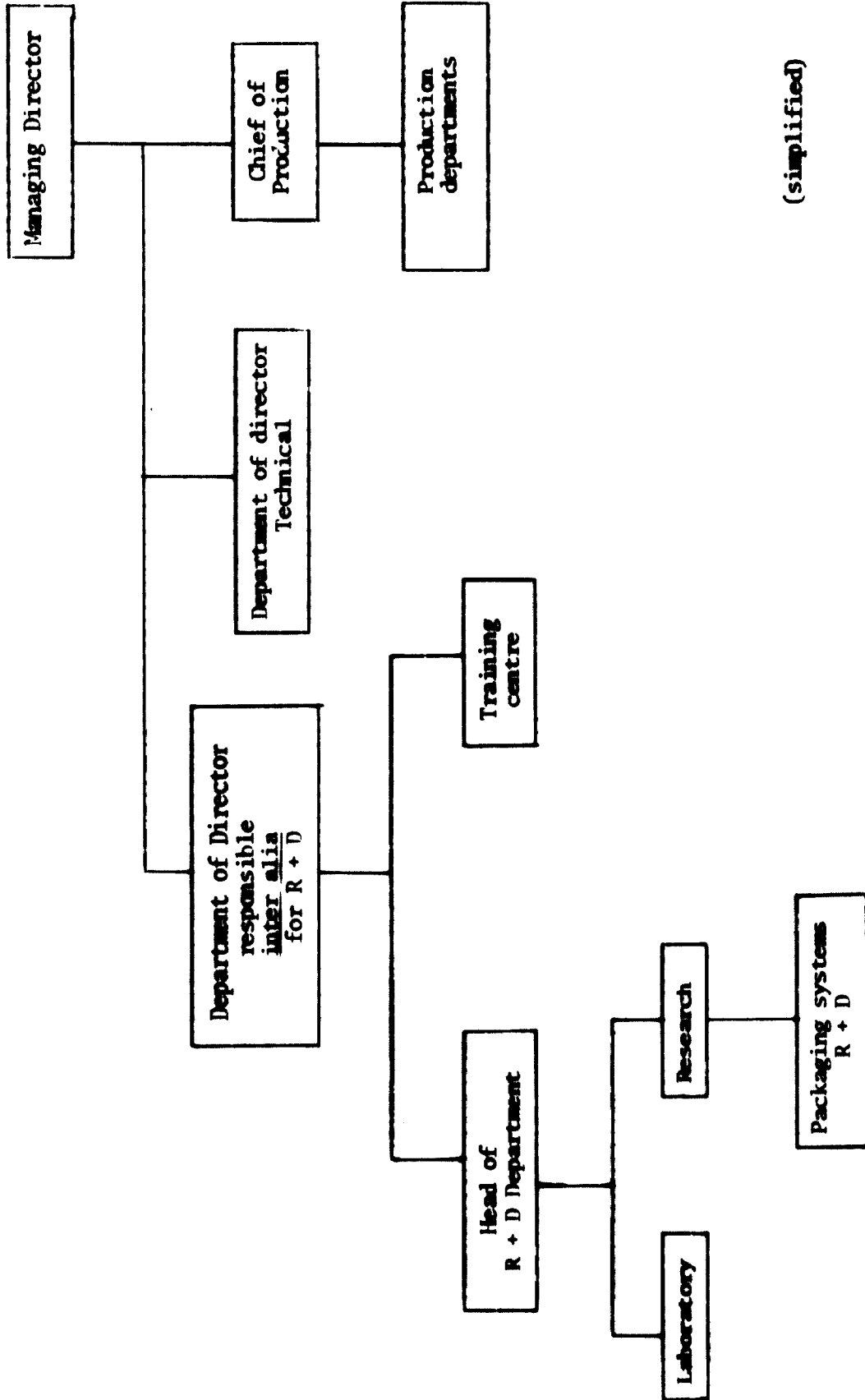
The basic properties of the plastic foils can be measured by means of the following equipment; such readings are fundamental for research and development work:

(a) Mechanical properties:

- (i) Instron Modell 1112, testing machine for the measurement of tensile strength, stiffness, compressive properties and friction;
- (ii) Davenport impact strength tester;
- (iii) Tear-resistance meter of Lorentzen and Wettres;

(b) Optical properties:

- (i) Gardner glossmeter;
- (ii) Gardner hazemeter;
- (iii) Gardner see-through-clarity-meter;



(simplified)

Basic organizational structure of the packaging demonstration plant

(c) Physical-chemical properties:

(i) Permeation cell;

(d) Electrical properties:

(i) Davenport electrostatic field meter.

I. FINDINGS

Main activities

The expert believes that the starting date of the assignment was far too early, for the reasons given here.

The plant started production of blown PE films in only the last few months; it is therefore still busy reaching a certain production and quality level. Unfortunately, the machines installed in the pilot plant (Flowpak, Illig) require other types of films. Recently, a vertical form-fill-seal (FFS) of Transwrap type has been installed. But some modifications of the sealing system are necessary in order to yield an effective output. The completion is scheduled for the near future. Only the self-produced shrink films can be processed on the Polystar machine. The Flowpak 250 has been tested using Polish material (Tomofan, a film like cellophane) with good results.

The expert put the Illig machine into operation, but he was obliged to use improvised material. It is possible to do a good job and profitable research work only with a wide range of foils.

The parameters determining the runability of a given material are known and in order to achieve such a runability close co-operation is necessary between the manufacturer of packaging materials and the packaging machine users. Such co-operation is also required to meet the demands of packaging consumers. Full specification of all essential properties, working conditions, or parameters is needed.

Practical work and trials after supply of all resources are the chief part of the work and not the writing of ambitious programmes. It is very important at the beginning stage to work practically and not theoretically.

Other activities

The expert prepared and initiated the testing procedure of the wettability of plastics films, especially polyolefines, by means of a practical and unsophisticated test.

He suggested the construction of a small device to test the burst strength of pouches. The device enables the staff of the laboratory to measure this property exactly.

The expert initiated the construction of a movable hand-sealing unit.

He discussed the aspects of lamination and laminated films using samples and technical literature. Because of its importance to the further enlargement of the Bialystok plant this work was covered comprehensively, including discussions of lamination processes, lamination machines, adhesives and related problems.

Further discussion took place about metallizing of films, performance and properties. Other important points covered were: ultraviolet curing of printing inks; adhesives without solvent; trends in the packaging of sweets; cake and biscuit packaging; retortable pouches; shrinking properties; special resources and plastics films; testing procedures; and recent technologies such as aseptic packagings.

II. CONCLUSIONS AND RECOMMENDATIONS

Now that the first phase has been accomplished in packaging with the use of films, the consultant believes that a clear conception for the next steps should be worked out by all those involved.

Further assistance

Laboratory equipment

The laboratory equipment should be supplemented by:

- (a) A laboratory sealing unit which allows the regulation of sealing temperature, time and pressure (cost about DM 7,000);
- (b) A room with air-conditioning system (temperature and relative humidity). This room is vital because all measurements of the physical or chemical performance should be done in a constant, controlled ambient temperature and with a given relative humidity;
- (c) A device measuring the permeability of oxygen such as Oxtran 100. This device enables the direct measurement of oxygen permeability using the flat film and/or the ready-made packaging. The knowledge of these figures is of greatest value;
- (d) Equipment for measuring gas permeability and water-vapour permeability for packaging coffee.

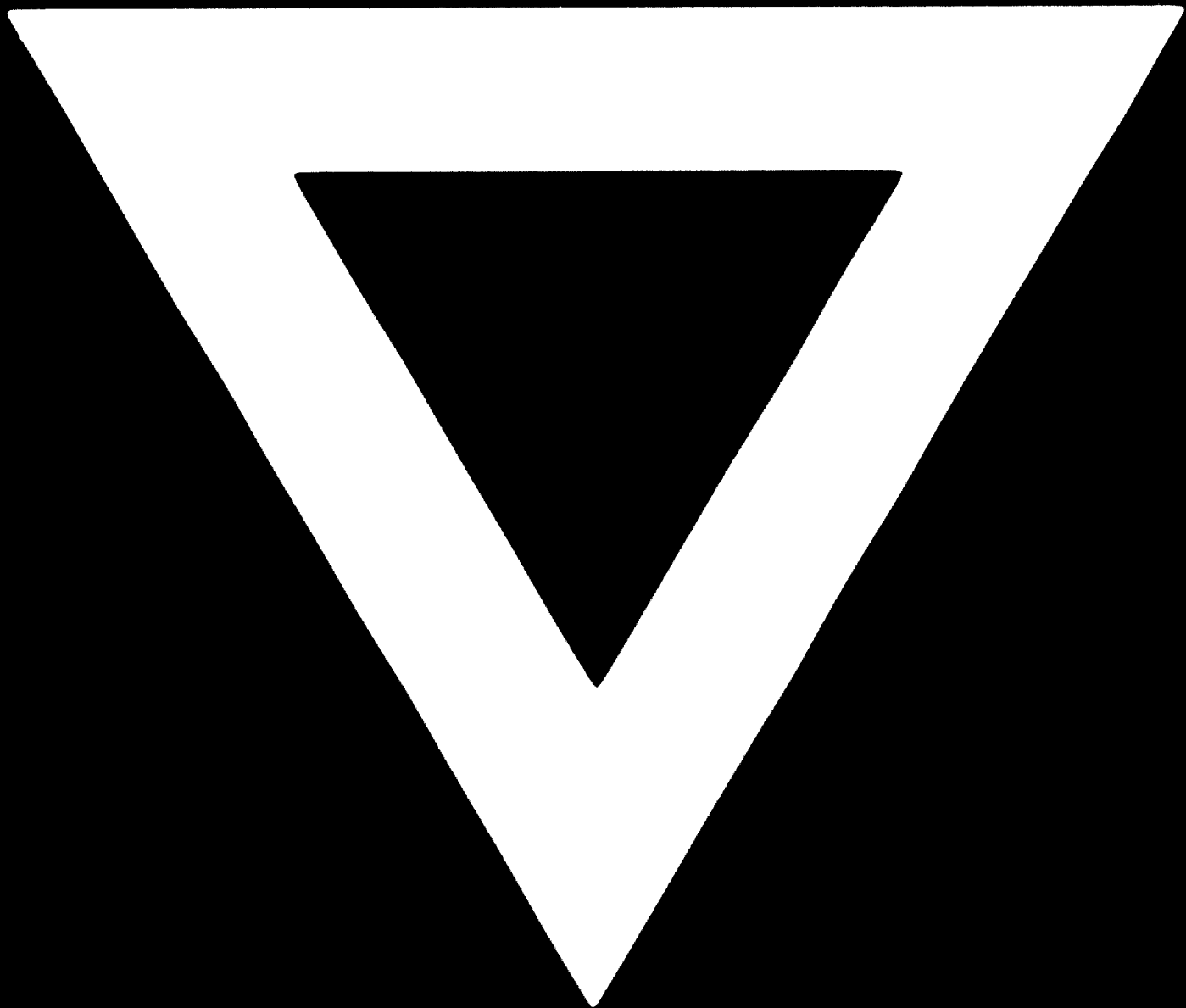
Technical information

There is an obvious lack of modern literature concerning packaging. It is important to know the western technological and technical periodicals. The consultant proposes that UNIDO assist the plant in obtaining the most important periodicals and other technical literature. Besides a knowledge of the literature and other publications the staff of development and production should be well acquainted with all the new materials, process engineering and machinery by attending special expositions (e.g. Interpack, Kunststoffe und Kautschuk K 75 at Dusseldorf).

Special training

To update and deepen the knowledge of new and modern technologies plant personnel might attend special courses or seminars covering such matters as thermoforming, new raw materials, special processing, arranged by PIRA, Verein Deutsche Ingenieure (VDI), Deutsches Kunststoffinstitut or by the companies producing the appropriate machinery or resources.

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