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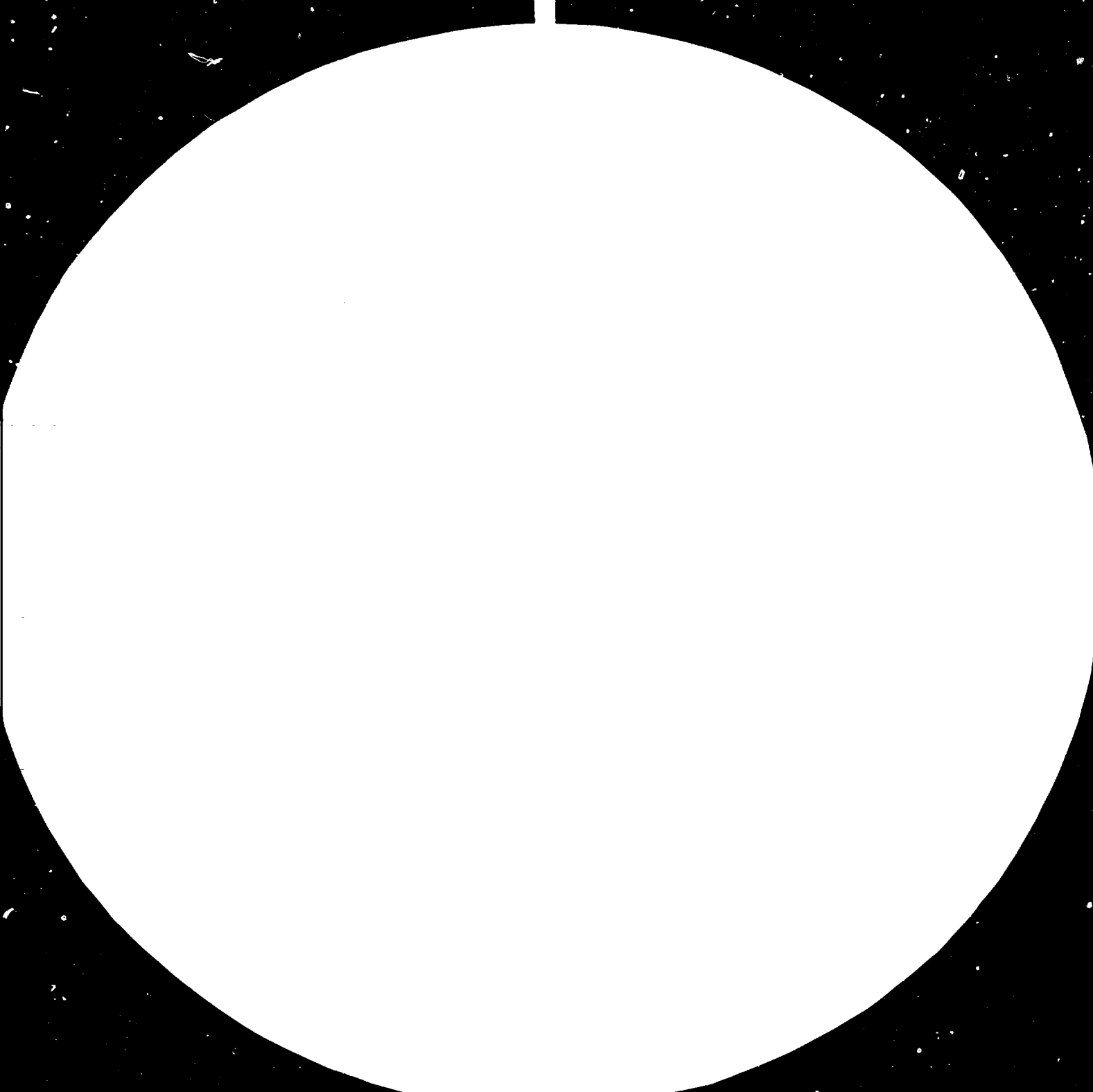
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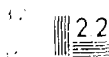
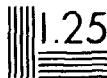
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ADAPTING TECHNOLOGY\*

An example from the Electronics Industry

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\*\*\* Philips' Pilot Plant, Utrecht.

ADAPTING TECHNOLOGY

An example from the Electronics Industry

1. Technology - the concept

English dictionaries provide a short definition of technology:

"The science of the application of knowledge to practical purposes".

The definition makes it clear that technology is a great deal more than just "technique". Relating the term to an industrial context makes its meaning clearer. It then includes: all the know-how required to develop, manufacture and to distribute a product, i.e. all the tasks that have to be performed in that process

- technical
- commercial
- financial and accounting
- industrial relations
- management
- research and development

Know-how, which consists of knowledge and experience, is found for the most part in the hands and heads of people. These people must be organised into a team by the management function and, at the same time, the elements of knowledge and experience of these people must operate in harmony and be directed at the desired result: the product in the hands of the customer.

Multinational enterprises transfer technology across national borders. This is done by people who should not only understand their job, but also the art of transferring technology. Not only must the various elements be integrated to form a coherent whole, but technology

originating in one country must be made to fit the conditions it will meet in its new location. This means that technology in question must be adapted. But, adapted to what?

2. Adapting technology

Internationally transferred technology generally has to be adapted. Technology transferred from the Netherlands to France has to be understood and used by Frenchmen - and that means more than just a translation from Dutch into French. For example, projection systems as used in drawing or transmission systems as used in television (PAL-SECAM) can be different. The adaptation of technology (making it "appropriate") became widely discussed when people began to realise that transfer to developing countries involves special problems and to appreciate how important successful transfer and adaptation is for the development of these countries.

To what does technology have to be adapted?

1. To the requirements of the customer;
2. to technical specifications associated with quality requirements which may be based on one standard the world over (especially in the case of products which are marketed internationally);
3. to the quantities to be manufactured;
4. to the people involved in production, in other words to their strengths and weaknesses as regards practical knowledge and experience, abilities, attitude to their works, etc.;

5. to the costs of the various elements: labour, energy, transport, materials, components, interest, etc.;
6. to the strengths and weaknesses of the infrastructure in which the industry has to function;
7. to possibilities and limitations of supply and service industries in the locality;
8. to government policies laws and regulations with regard to imports, foreign exchange, investment, labour relations, industrialisation, transfer of technology, work permits for foreigners etc.:
9. to the policies of the enterprise in question and/or the international group to which the company belongs:
10. to the risks as perceived by management.

Adapting technology is therefore a many-sided problem which is not limited to modifying techniques. It is an essential condition for success. Adapting technology is a process that has in fact been going on for many years - albeit with set-backs as well as successes, because it is often approached unsystematically and by people with insufficient experience. It is not a coincidence that the government of Singapore has stated that established and experienced multinational concerns have seldom failed when establishing export companies in Singapore, while less experienced international concerns and local companies experienced a higher rate of failure.

The third section of this article provides some information about Philips experience in providing appropriate technology for smaller developing countries which are in the early stages of industrialisation.

When the specific problems of these countries were recognised approximately twenty years ago, a special Pilot Plant was established near Utrecht. The part of the Pilot Plant which deals with manufacturing processes is concerned mainly with assembly technology. However, it also takes account of all other aspects of adapting technology.

3. Adapting technology in the electronics industry

The ten points mentioned above are discussed below in more detail.

1. In principle, consumers in the developing countries expect products to meet the same technical specification as those in developed countries. More portable radio sets are bought, less HiFi, etc. but the customer is just as critical as regards the technical qualities and appearance. In some cases, the requirements are more severe, e.g. where variations in voltage and less efficient transmitters are found or, as in the tropics, where temperatures and humidity are higher.

2. Both the requirements of the customer and world-wide quality requirements of an electronics supplier such as Philips mean that no compromise is allowed with regard to technical specifications. The transferred technology must therefore be based on international specifications and adapted to meet them.

3. The markets in the relatively poor, smaller developing countries are often small. The size of production runs is correspondingly much smaller than in Europe, for example. As a result of this, one of the most important aims of adapting technology



is to manufacture small numbers at an acceptable unit cost. The unit cost of components is sensitive to economies of scale; consequently they have to be imported in many cases.

4. People in the countries in question often have little training and in many cases even less practical experience in industry. This is also true of employees who are potentially suitable for management positions. Untrained labour has in most cases no industrial experience and limited basic training. Operating manuals have therefore to be illustrated in perspective rather than with the usual technical drawings. Wherever possible, machines must be simplified, both to make their operation simple and to make on-the-spot repairs and maintenance possible.

Simplification must also take place in areas such as physical distribution and accounts. The "computer language" of the large parent organisation must be translated back into symbols comprehensible to the layman. Untrained people are often at an advantage in one respect: they have better memories. This makes it easier for them to perform the long work cycle (a large number of operations) associated with small production runs.

Imported management must also be "adapted". They must have wide and thorough experience. They must control a large number of areas for which a specialist would be available in Europe. They must be patient. In terms of logistics they will often have frustrating struggles with an imperfect infrastructure and bureaucracy. If they have families, their children will often have to be brought up in the face of difficult circumstances.

5. Wages are often low, but productivity is also low. In any case,

the wage factor is smaller than is generally thought. What is high is the cost of capital invested in stocks, because stocks are large and interest is high.

A factory in Tanzania had a turnover of 24 million guilders in 1978, an investment in factory premises of 1 million guilders and of 0.8 million guilders in machines, but needed to have as much as 11 million guilders tied up in stocks. Far and away the greatest part of these stocks was in transit to the factory or in transit to the customers. This demands reliable machinery which has to be adapted both economically and technically to the scale and the circumstances. Logistics which are slow to adapt are expensive, both for a company and for a country. Components are often expensive because of high import tariffs and the same is true for energy and a large number of materials. Economical use of energy and materials is therefore important. Many things that are thrown away in industrialised countries have to be repaired in developing countries - assuming, that is, that the skills required are available.

6. Large stocks result from the long supply lines and the poor infrastructure. Also, repeated power failures have a hampering effect on continuity in operation of the company and the flow-through of goods. This all requires special provisions and therefore appropriate technology.

7. A concern such as Philips spends an average of 50% of each guilder it earns on purchasing. Many thousands of suppliers throughout the world sell components, materials, etc. to Philips. However, in the smaller developing countries there is often scarcely any supply industry. Insufficient purchasing possibilities complicate

management and a factory has to rely on its own resources for more items, or on uncertain imports. The few suppliers that there are often require technical assistance before they are in a position to make the desired components (plastics, metal goods, etc.) in accordance with the required specifications. It is therefore appropriate that the components for equipment and mechanical constructions should be produced in a simplified form in order to permit production locally. This can also make the locally used jigs and moulds simpler and cheaper.

8. Governments often lay down rules and regulations which can sometimes be contradictory: cheap production in small batches coupled with minimum imports due to a lack of foreign currency - in other words, local manufacture of components in batches which are too small; limits on payments for the transfer of technology and yet a need for a great deal of foreign know-how to build up industry. Nevertheless, shortage of foreign currency, importing work into the country and laying the foundations for an industry represent real problems which cannot be by-passed if the foreign enterprise wants to be a "loyal citizen".

9. An important policy principle is that control is desirable in a firm making products which carry the trade mark of the company. The question as to whether control is exercised by the parent company or not then becomes important. However, this cannot be determined simply by reference to share capital percentages. Adaptations of technology in the field of the management function can make good solutions possible. The maintenance of high standards is a matter of practical and international experience, personal

qualities and a thorough knowledge of business are important in this respect.

10. There are many different risks which must be taken into consideration: political and foreign exchange risks which compel a limitation of invested capital and therefore a limitation in stocks and capital equipment. The latter is associated with attempts to simplify machines and equipment. Simplification of machines also reduces the risk of breakdowns in the production process. The risks of interruptions in supplies and the idle time resulting from it are inconsistent with attempts to limit stocks - it is advisable to hold buffer stocks. The risk factor is therefore an important one when adapting technology. The costs of transport also have great influence on the final unit cost. Finally, we must not forget rapid technical developments which make frequent modifications both to the products and to the processes essential.

Thus, adapting technology is a dynamic process which should be included in all functions in the concern and which places demands on no fewer than ten different divisions, requirements which vary from case to case and from year to year.

