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BASIC ELEMENTS OF INDUSTRIAL COST ACCOUNTING

A Preparatory Note for
"Analytical Profiles of Manufacturing Establishments"

Prepared by
the UNIDO secretariat

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I. INTRODUCTION - COST ACCOUNTING AND ANALYTICAL PROFILES OF INDUSTRIAL ENTERPRISES

The purpose of this paper is to describe, very briefly, the distinctive features and techniques of industrial cost accounting with a view to preparing for an analytically oriented approach to the "Profiles of Manufacturing Establishments". Cost accounting is by itself an extremely complex area. This paper is written as an idea that a quick note for bringing up certain basic concepts that should be properly dovetailed into the new Profiles programme, the technical details of which are yet to be established. It is beyond its scope to attempt to draw up a definitive standard framework of cost accounting amenable to diverse practices in different countries and different enterprises.

The Profiles of Manufacturing Establishments,[1] now available in a UNIDO publication series, provide summary data in a capsule form on the structure and performance of existing industrial establishments and enterprises in various developed and developing countries. This particular data series is focussed on a grey area between engineering data on the plant level and more aggregative statistics on the sector level. Therefore, it adopts an enterprise or establishment as the basic activity unit at which level primary data on economic variables and their inter-relationships are controlled and compiled in a comparable form. Except in relatively rare cases where production involves a single process and a single product, however, the data aligned and controlled on that level do not very easily lend themselves to economic analysis of productivity and cost-price relationships. In fact, many of the cases contained in the series refer to industrial enterprises and establishments which have different product assortments and process mixes. It is thus difficult to analytically compare the cost price data of a given specific type of product or plant between different enterprises.

Another drawback in the earlier Profiles approach is that the basic data were derived more or less directly from the records associated with general and financial accounting. Very often, substantial differences are

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1/ Profiles of Manufacturing Establishments, Volume I (ID/SER.E/4, Sales No. E.67.II.B.17) and Volume II (ID/SER.E/5, Sales No. E.6?.II.B.13). Volume III, containing cases from other countries, is now being printed.

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...ted between the information filed for the purpose of general accounting and the information considered important in the context of diagnosis and programming of industrial plants. General accounting records tend to assume various financial and institutional factors that often obscure the real techno-economic relationships of industrial production. Within an enterprise or establishment, cost accounting is a customary means of compiling data free from such factors and more immediately useful for its internal decision-making purposes, such as determination of selling prices, assessment of the productivity in various departments, evaluation of new investment proposals, etc.

While the principles underlying cost accounting seem to be well standardised, the manners and procedures in which these principles are actually applied widely vary from one enterprise to another. In enterprises of relatively small size, and particularly those with relatively meagre managerial staff, fully-fledged analysis of plant performances in terms of cost accounting is rarely undertaken. Even where cost accounting is practised as an important management routine, the information compiled under this routine is strictly confidential and intended to serve only each particular enterprise's own purposes.

Therefore, if cost accounting techniques are to be introduced within the framework of enterprise or establishment profiles, great care should be exercised in drawing up a scheme of data collection and analysis that can be applied more or less commonly to different enterprises. Such a scheme ought to be sufficiently simplified to meet just the specific purpose of the Profiles programme without threatening the commercial interest of participating enterprises.

Moreover, in order to warrant the voluntary participation of enterprises in the analytical exercise, it would indeed be important that the Profiles programme be instituted as a joint study of the staff of the programme and the enterprise management whereby the latter benefits in the form of productivity advisory services on a tête-à-tête basis. The information compiled by such a joint study would only partly - and in a properly neutralized form - be utilised for the research interest of the governmental authorities regarding the inter-firm (and inter-country) comparative

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problems of the enterprises considered and the propriety of the national strategies and policies for industrial development.

In the following, first, the concept and the structure of costs in cost accounting, as distinguished from those of expenditures and expenses in general and financial accounting, are briefly described (Section II). There, attention is drawn to the "neutral" expenses which are to be eliminated for cost accounting purposes and the "additional" or "imputed" costs which are not included in general accounting but are important for cost accounting purposes.

Section III then describes the main categories of cost to be considered and their behavioural characteristics in terms of direct and indirect costs. It should be noted that, while the types of cost to be charged as direct costs depend on the organizational set-up of accounting in individual enterprises, the bulk of costs-expenses tends to behave in the form of overhead costs, and that a main part of the costing exercise consists in properly attributing the overheads to relevant departments and products (or product lines).

Then, Section IV refers to the "cost centres" at which the costs occurring at different processing units are identified. After all the relevant costs, including administrative overheads, have been duly allocated to respective cost centres, it becomes possible to determine the costs and prices of various products at intermediate and final stages.

The typical procedures for product costing and pricing are illustrated in the final Section by five examples. To meet the specific interests of the Working Party, these examples are drawn from the following five enterprises in different branches of industry:

(i) Wool combing, spinning and weaving;
(ii) Vegetable oil refinery;
(iii) Soap making;
(iv) Organic chemicals; and
(v) Phosphate fertilisers (normal superphosphate).

In each of these examples, first, the input-output characteristics of major processing departments are briefly described. Then, a schematic cost statement, by cost types and cost centres, is tabulated. Finally, the

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manner in which the selling prices of marketable products are determined be demonstrated.

[illegible] OF COST IN COST ACCOUNTING

Financial accounting records all transactions related to stocks and supplies as well as all expenses and revenues occruing during an accounting period. It keeps an exact record of the financial resources of a company and serves management to control and maintain the company's financial liquidity. Financial accounting is a concept of periodical accounting.

The same holds true for general accounting, which serves more general purposes of an enterprise: e.g. it furnishes all information required by groups like shareholders, creditors and tax authorities who do not have direct access to the company's internal records. Profit and loss statements as well as balance sheets are prepared for such purposes. While general accounting serves some decision-making purposes, it is to provide a barometer of the performances of an enterprise as a whole, rather than an analytical tool for internal planning and decision-making.

Cost accounting is also a concept of periodical accounting. It has more analytically oriented tasks. It keeps track of all the services rendered and products produced and sold or consumed internally, in relation to specific cost centres and jobs/products within an enterprise, where the corresponding costs are identified and compiled for evaluation purposes. Cost accounting is thus a tool for managerial decision-taking. It can be utilized to check the efficiency and profitability of each department or cost centre, and it provides the basis for product costing and pricing.

In cost accounting, costs are defined as the input of value which is required for the production of goods or services. The sum of all revenues resulting from sales of products and services is equal to the turnover of an enterprise. This corresponds to the total value of production in the accounting period, after the adjustment for net changes in the inventories of semi-finished and finished products. It should be noted that the turnover in the above sense does not include neutral revenues, i.e. revenues resulting from the enterprise's operations not associated with the production of goods and services.

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These costs are valued in monetary units, we refer to them as input of value. It is important to note that under normal conditions only inputs required for the production of goods or services constitute costs. In the following, attention is drawn to the difference between the three concepts "costs", "expenditures" and "expenses".

<u>Costs and "expenditures"</u>

Expenditures are all amounts that are paid by the enterprise for material and non-material inputs. But the expenditures during an accounting period do not always necessarily correspond to the costs accruing in the same period. Exact observations and recording of the time-lag between expenditures and costs is of great importance for the accuracy of cost-accounting. Costs are related to cost accounting, while expenditures are a concept of financial accounting. An opposite counterpart to expenditures is "receipts".

The following distinctive characteristics of "costs" should be noted:

(a) <u>Costs that are not expenditures (nor expenses)</u>;

e.g. - Consumption of goods acquired free of charge (e.g. through inheritance or marriage);

- Interests on equity capital; remunerations for unpaid work;

- Imputed depreciation over and above book value depreciation;

- Utilisation of self-manufactured goods in the enterprise

(b) <u>Expenditures that are not costs</u>:

e.g. - Goods which though acquired, were not consumed but only utilised (production site);

- Expenditures leading to consumption of goods, which, however, were not caused by the productive objective of the enterprise;

- Expenditures not leading to compensatory income for the enterprise (e.g. income tax deducted at source, private expenditures, distribution of profits).

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(c) [illegible]

- Costs before expenditures or consumption before payment (e.g. wages, rents, taxes paid subsequently);
- Costs after expenditures or consumption extending over several periods (e.g. stock of material, utilization of fixed assets, etc.)

(d) [illegible]

Costs are valued at current market values; expenditures at the agreed value.

Costs and "expenses"

Expenses are equivalent to the consumption of goods and services irrespective of whether or not this value of input serves within the framework of the establishment's objective. The total amount of expenses within a period can be divided into operative and neutral expenses.

The operative expenses correspond to the consumption resulting from the enterprise's objectives and are included in the total costs during an accounting period. Neutral expenses have to be separated from costs, as will be explained below

Expenses are a concept of general accountings they are related to costs but they are not necessarily identical. As opposite to expenses is revenues. Costs identified for cost accounting purposes are derived from the expense accounts for a defined period of time or field of operation (department).

Cost accounting is mainly based on figures derived from general accounting, in particular from the expenses shown in the periodic profit and loss account. All additional costs not considered in general accounting have to be added, while all neutral expenses have to be eliminated. That is to say,

[Expenses] - [neutral expenses] + [expenses equal to costs]

[Costs] = [costs equal to expenses] + [additional costs]

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"Additional costs"

Additional or supplementary costs represent all those costs which are not recorded as "expenses" in general accounting. The following four are the main "additional costs" to be considered in cost accounting:

(a) Imputed remuneration for the entrepreneur and collaborating members of his family who are not wage-earning or salaried employees of the enterprise (this imputation is only valid in the case of one man businesses and partnership companies);

(b) Imputed depreciation which is to replace the depreciation allowance shown in the profit and loss account when the latter does not represent the contribution of fixed assets to productive costs during a given accounting period;

(c) Imputed interest is to be calculated for the adjusted equity capital (equity + reserves) at the same rate of interest which has to be paid for loan capital;

(d) Imputed risks which purport to smooth the time distribution of those risks which occur irregularly in the form of extraordinary expenses.

These imputed costs will be mentioned later in a little more detail in connexion with the "capital costs" (Section VII).

"Neutral expenses"

The enterprise's objectives as well as special conditions related to the production process should be taken into account in determining the neutrality of certain expenses.

Neutral expenses can be divided into:

(a) Expenses not related to the enterprise's objectives, such as expenses for maintenance of equipment which no longer is required for the operation of the company; capital participations not required for the running of the business; allocations to outside persons, e.g. for social associations, etc.;

(b) Extraordinary or non-recurring expenses:
Though being caused by operations of the enterprise, these occurrences are not regarded as normal, e.g. losses of loss of properties. In cost accounting imputed risks take care of such losses, e.g. bad investments, receivables, credit, guarantees, exchange losses, etc.

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(c) **Expenses affecting the revenue accounts**
There are expenses that do not affect the expense side but directly affect the revenue side. Such expenses include rebates, bonuses and other refunds that are granted by the enterprise and decrease the respective turnovers.

Conclusion

Besides these normal and additional expenses, attention should be drawn to expenses that should be recognized to measure the real cost occurring during a given accounting period and to ensure continuous fulfilment of the enterprise's objectives. General accounting is of a more documentary nature and reflects the past course of transactions and operations as it has actually taken place. Cost accounting is of an instrumental nature (i.e. it serves as an instrument of management) and therefore keeps abreast of current market values. When input materials are subject to appreciable price fluctuations, the value of materials consumed during given period should be adjusted in such a way that they can be fully replenished for the operations for the following period.

3.1. MAJOR CATEGORIES OF COST

Costs can be classified in various ways. For the purpose of cost centre accounting and product costing, it is essential to distinguish between direct costs and indirect costs.

Direct costs

Direct costs are costs that may be directly charged to an individual product or product line. The extent to which costs may be charged as direct costs depends largely on the organizational set-up of the accounting system of a company. The greater the proportion of costs that can be charged direct costs, the more accurate will be the calculation of product costs.

The most important direct costs are "direct production materials" that form an integral part of the finished products. Wages payable on a piecework basis or wages to be paid proportionally to a well quantified amount of work performed fall in the category of direct costs. In practice, however, such direct labour costs are limited to manual operations, such as

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manual packing, and even these tend to involve an element of indirect cost due to certain employment regulations. Operatives attending machinery might be classified as manual workers for some purposes. But for cost accounting purposes, particularly when a job involves relatively substantial capital costs, their wages are customarily classified into indirect labour costs.

Special selling costs, such as special packing for particular markets, turnover taxes, etc. are directly chargeable to specific products. Customs duties for imported materials are also susceptible to a similar treatment.

Indirect costs (overheads)

Indirect costs are costs that cannot be charged directly to a specific product or service but quite generally contribute to the cost of production. Rents, insurance premiums, interests, heating costs, etc. are the most obvious examples. In fact, a great part of factory costs (other than costs of direct production materials) have more or less appreciable characteristics of indirect costs and are treated as factory overheads. The allocation of the overheads to specific products calls for a degree of approximation.

Apart from the distinction between direct and indirect costs, it is customary to identify different cost categories according to their characteristics in terms of utilization. Material cost, personnel cost, capital cost, service charges, and taxes are the major categories frequently utilized in the preparation of cost statements. In the following, these major categories are only briefly described.

1. Material cost

This includes both direct materials which are processed and embodied in semi-finished and finished products, and indirect materials which it is difficult to charge to specific products.

The concept of "material" is not only applied in enterprises concerned with manufacturing but also in repair and installation works and other services as well. In commercial establishments, material is an article of merchandise. In enterprises engaged both in manufacturing and in commercial business, these differences in terminology must be accurately observed,

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i.e. "merchandise" only for commercial transactions and "material" only for manufacturing activities.

The more accurately store accounting is handled, the more material may be identifiable as direct materials, which in turn result in a more accurate and reliable costing.

Direct materials are charged directly to the individual product of the enterprise since they form an integral part of the output. As a rule direct materials are comprised of raw materials.

The term indirect materials refers to material that is needed for the completion of the product but cannot be charged directly to specific units, lots, or products.

"Auxiliary material" or "accessory material" refers to the material which, though being necessary for the manufacturing of a product, usually is not charged as direct material, because of its low value or low quantity necessary for the manufacturing of the product. Examples are: solder, varnishes, acids, abrasives, etc.

Factory supplies include those materials which are needed for the operation and maintenance of machinery and equipment in the production process. It is possible to determine to what extent given factory supplies are used for a specific product or for a particular order. But, in practice, factory supplies are often treated as overhead costs. Examples are: lubricants, repair material, heating material, power supply not directly chargeable to product, etc.

Personnel costs

Components of personnel costs may be classified according to their basis of accrual as follows:

(a) Basic remuneration for normal activities (e.g. wages and salaries).

(b) Allowances and premiums for special activities: According to type of activity, such allowances relate to, for example, work in dust, heat, coldness, work detrimental to health (lead, poison, radioactivity), work in high altitudes, blast furnace operations, etc.; allowances for errors (cashier), tools and clothing, travel allowance, meal allowance, accommodation allowance, etc. are also

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considered here. In relation to time of activity, allowances for night work, Sunday and holiday work and overtime are also included here.

(c) Special payments: Paid holidays, sick leave, payments for births, weddings, etc., as well as payment of wages and salaries for idle time (due to lack of work, unsuitable weather, delayed supply of material, etc.)

(d) Other regular payment components
Payments in kind: free accommodation, allowances in kind, etc.
Premium wages: premium for lower wastage rate, output bonuses, etc.

(e) Security cost: Compulsory (based on social security legislation, collective bargaining, or special agreement) or voluntary payments.

Personnel costs are also classifiable, according to types of employment, into wage costs and salary costs.

Wage costs consist of

(a) the basic wages (payment for time worked, piece-work, and premium payments, overtime plus overtime premiums, holiday, Sunday and night work bonuses and various types of premiums, which are already referred to above), and

(b) supplementary wage costs. These are all those personnel costs which arise simultaneously with basic wages and which either directly or indirectly depend on the amount of the wages to be paid. Employer's contribution to social security is an example that is directly dependent on the amount of wages paid. The length of service in a given enterprise is often used as a basis for calculating special allotments under a profit sharing scheme.

Salary costs are part of the factory overheads and the administrative overheads. In exceptional cases, however, salaries may also be directly charged to a specific product (e.g. salaries of constructors whose work is connected with the installation of specific products). Salary costs will also involve "supplementary" components as in the case of wages. Supplementary salary costs depend either directly or indirectly on the amount of salaries to be paid.

In the case of small firms in which the family members of the owners often participate in productive activities without having a recognized status of employee on the pay-roll, imputed remunerations for their work ought to be included in proper cost accounting. The imputation of such unearned remunerations will be based on what the cost would be if these

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people were substituted by normal employees of comparable ability. However, imputed entrepreneur's remunerations should not be confused with the private expenditures which a firm owner might wish to make on the firm's account for other purposes than the production objectives.

3. Capital costs

In trade and industry, capital as a production factor has gained increasing importance. Capital is necessary to finance the investments necessary in an enterprise, both with regard to fixed assets and with regard to current assets.

In cost accounting, great care should be exercised in identifying the part of the capital costs which should be considered as accruing in a given accounting period. Imputation should be duly performed to correct the insufficiences or distortions occurring in the financial and general accounting records.

(a) Imputed depreciation

Imputed depreciation differs from book depreciation in the sense that it intends to assess the contribution of fixed assets to annual production independently of legal provisions. Imputed depreciation is applied as long as an asset is used by the enterprise. Assets having already been fully depreciated on the book but still being used for production purposes may, therefore, continue to be subject to imputed depreciation. The basis for imputed depreciation is the replacement value. If an enterprise succeeds in recovering imputed depreciation in addition to other costs, replacement is guaranteed.

In order to determine imputed depreciation it is necessary to keep a fixed-assets register or ledger. This shows the original purchase value of each fixed asset, the date of purchase and its expected economic life. Frequently, fixed assets which have already fully or largely been written off are shown at their present market values which practically results in making hidden reserves visible. The present market values of such fixed assets are taken into account for the determination of the adjusted net worth.

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For the sake of simplicity, the calculation of depreciation charges is usually based on the assumption of continuous utilization. From the standpoint of cost accounting, however, it would be more accurate to relate depreciation charges to the performance as well as the age of the assets (e.g. depreciation of a car should not be based on time but on the amount of miles travelled)

(b) Imputed interest

Equity capital is subject to imputed interests in cost accounting. It has to be assumed that the capital resources invested in an enterprise yield at least the market interest rate. The calculation of imputed interest charges is based on the adjusted net worth equity capital (i.e. net worth including reserves). They constitute "additional" or supplementary costs, i.e. they are only used for cost accounting purposes. Interests paid on loan capital are actual expenses and are readily included in capital costs.

The interest rate at which imputed interests are calculated corresponds to the average bank rate for long-term deposits.

(c) Imputed risks

Imputed risks constitute a premium for part of the risks that is not insured and takes the form of occasional extraordinary or non-recurring expenses. Imputation will be based on the average value of such expenses (cases of loss) recorded during preceding years. By using average values one assures a more equal distribution over different accounting periods of the costs which actually accrue in varying amounts over time. Imputed risks are also part of the supplementary costs. When these are included in costs, the actual extraordinary expenses should be considered as "neutral" expenses and eliminated from costs.

Imputed risks are to be included in cost accounting either as overheads or as part of the profit mark-up. They are only to be calculated if these risks cannot be covered by an insurance.

Examples of imputed risks:

- Inventory risks: losses caused by shrinkage, decrease in quality and depletion of material;
- Fixed assets risks: breakage of machinery;
- Guarantee risks: services required during the guaranteed period.

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4. Service charges

These include costs for transportation, rent, lease, power consumption, patents, licenses, consultant services, etc, as long as they are not included under other types of costs. In almost all cases they constitute overheads.

5. Tax costs

These include all taxes other than income and profit taxes. Turnover taxes are considered as a direct cost. Property taxes, employment taxes and other (non-income) business taxes constitute overheads.

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IV. COST CENTRE ACCOUNTING AND PRODUCT COSTING

Cost centres

Cost centres usually correspond to the departments of an enterprise to which costs are charged as they are incurred to them during an accounting period. In most cases, cost centres are identical with production units or departments locationally so identifiable, e.g. turnery, foundry, finishing, etc. Additionally, there are cost centres created by the organization of accounting, not referring to any specific location but represent functional units of an enterprise, such as marketing.

The most common cost centres are:

- Stores (raw materials, intermediate and finished products);
- Production (e.g. turnery, cutting, etc.); and,
- Management and administration (including sales and purchase department, designing, cost accounting, personnel, etc.).

Within a cost centre, production activities are seldom homogeneous but often involve:

- Different kinds of production process: e.g. manual and machine work; and,
- Different kinds of product manufactured or services rendered: e.g. furniture masoning, construction carpentry, etc.

Cost centres should be set-up in such a way that each centre is equipped with an employee who keeps track of all the costs arising there.

Cost centre accounting is in many instances carried out on a schematic cost statement.

SCHEMATIC COST STATEMENT

Cost types	Stores	Production I, II, III ...	Administration
(Material costs)			
Personnel costs			
Capital costs			
Service charges			
Taxes			
(Special sales cost)			
Total overhead costs			

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Examples of such statement are given in the following section.

Product costing and pricing

The products manufactured or the services rendered by an enterprise are either intended for sales or for internal consumption. Ultimately, all costs have therefore to be charged to the products or services rendered.

Products or services intended for internal use or consumption such as self-produced machinery and tools, maintenance and repair works by own service personnel create also overheads as well as direct costs. These have to be controlled and properly evaluated as marketable products. Only in this way it is possible to determine whether it is cheaper to have the desired product manufactured within the enterprise or to purchase it from outside.

Basis of any pricing policy should be the manufacturing costs of the enterprise, the supply and demand structure of the market as well as the economic policy of the Government which strongly influences the price structure through subsidies, customs duties and price fixing. The price, at which sales actually take place, is not often equivalent to the "calculated" price. It is the task of management to gradually find the price that may be carried by the market. This price should at least cover all costs accruing (cost-covering price) since only this guarantees that depletion is avoided. Only in the case of monopoly, an enterprise may freely calculate the prices of the individual products or services, i.e. sell such products or services at prices which include a desired markup. For enterprises which do not enjoy a monopolitic position, pricing policy is more than calculation: they have to try to realize the highest possible profit by continuously weighing the obtainable prices against the accruing costs; their pricing policy has thus to rely on the necessary information from the market as well as from cost accounting.

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Absorption costing and partial costing

In regard to pricing, two different costing procedures should be noted: absorption costing and partial costing. Either actual (historical) costs or standard costs can be applied to both procedures.

The combination of absorption costing and historical cost data is the most common practice. This is based on the principle that all the costs that have accrued during a given accounting period should be charged to the products manufactured or services rendered within the same period.

All cost data will be collected by types of costs (or categories of cost). Costs may then be charged either directly or indirectly to the respective products. Whereas the determination of direct costs (mainly direct labour, direct materials, turnover tax) does not create any difficulty, the share of each particular product in the total factory overheads (indirect costs) cannot be determined exactly, but it can only be estimated by way of approximation. The attribution of the factory overheads to various specific products is thus performed in the form of rates of surcharge.

In this context, it is convenient to use cost centre accounting. For cost controlling purposes, indirect costs are first collected at those cost centres (departments) where they have accrued and have been so recorded. The factory overheads thus identified at an individual cost centre is then absorbed by specific products handled by that centre according to certain criteria, such as relative machine hours or process time. This last phase actually is product costing. The sum of direct and indirect costs, as well as of extraordinary costs and profit mark-up, which must be carried by each product in one way or another, is the basis for product pricing policy.

In this context, it should be emphasized again that the results of any costing system will be the more accurate, the greater the number of cost items that can be charged directly. This depends upon the organization of an enterprise, and its

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recording and accounting routines.

The increasing share of fixed costs in the mix of production factors especially in some branches of industry (mechanisation, automation) causes the share of factory overheads (indirect costs) to grow, and the share of direct costs (especially the share of direct labour) to decrease. This adversely affects the reliability of product costing.

Direct or partial costing circumvent this problem. This approach consists in adjusting cost recovery or pricing policy to the effective market price structure. An elaborate product costing would lose its significance if the product could not be sold at its calculated price. The objective is not to get the highest possible price for every individual product, but to obtain effective prices of all products in such a way that they can yield a total revenue covering all costs and containing wherever a positive profit may be possible. In the short-run or under special circumstances, it can be permitted to sell at a price that covers all variable costs of the product but not all the fixed costs. Within a given plan capacity the sum of fixed costs is considered to be invariable. It does not necessarily have to be shared by every individual product. The obtainable prices which yield more than the sum of variable costs, can only contribute to the recovery of fixed costs (marginal contribution). Therefore, the acceptable minimum price would be equal to the sum of variable costs. The difference between absorption costs and direct (partial) costs, which could not be covered in a given period, ought to be covered eventually in subsequent periods.

In the long-run, it is absolutely necessary that both fixed and variable costs be covered in order to maintain the viability of the enterprise. With partial costing, however, the pricing policy of an enterprise becomes more elastic and is much more adjustable to short-term market fluctuations. Partial costing is theoretically justified by the behaviour of costs at varying levels of capacity utilisation

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1/ It should be noted that the two types of costing just described refer to actual costs that arise during given accounting period. Provided no changes occur, the co costing figures will be applicable in the following period. If, however, changes are to be expected, they should be taken into account in pricing. The costing based on expected costs is often referred to as standard costing.

V. [redacted]

Five examples are presented below with a view to demonstrating the typical procedures for establishing costs occurring in various processing departments (cost centres), allocating the administrative overheads to these departments, costing different products produced in a given department, and calculating the selling prices of final products as well as those of intermediate products where applicable.

These examples have been derived from a sample held in a consulting firm in Europe. Although the figures are not totally fictitious, they are rather hypothetical in nature, and no reference value ought to be attached to the magnitude of cost parameters involved in these figures.[1]

The five examples refer to five enterprises in different branches of industry:

A: Wool-washing, spinning and weaving
B: Vegetable oil refinery
C: Hard soap
D: Organic chemicals
E: Superphosphate.

The last example (E) deals with the simplest case, in which the plant produces a single product and its various processing units are completely vertically integrated.

Example A deals with a case where different process departments are not well balanced in their relative capacities; as a result, some of their intermediate products are partly sold on the market and some are supplemented by products purchased from other enterprises.

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[1] The unit of currency involved in the value data is not specifically indicated in these examples. However, for those who seek a degree of realism in the figures, it might be helpful to note that the value data has been prepared in a currency unit equivalent to about 4 U.S. cents.

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Example 3 is taken from a case involving different brands of product subject to different unit costs. For the department producing them, job order accounting has to be undertaken, in addition to process costing, in order to allocate the manufacturing overheads of the department to the respective brands of product.

In Example 4, the enterprise sells part of its intermediate product at a competitive (pre-fixed) unit price, which happens to be lower than the price at which the full cost of the product (including administrative overhead and turnover tax, not to speak of normal profit margin) could be recovered. In this example, the cost burden at this intermediate stage is shifted into the pricing of the final products.

Example 5 is the most sophisticated of the five examples. The enterprise has not only its own electricity and steam generation units, but also its process departments produce a range of different types of product. To permit the costing of different product lines, job order accounting is utilized extensively in this example.

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Example A: [illegible] WOOLEN MILL

The enterprise has three processing departments, each producing one type of output only. Thus, each department can employ process cost accounting. Only material costs are considered as direct costs and turnover taxes as direct sales costs. These are not added to the "total overhead costs" in the schematic cost flow set. The general overheads recorded in the "Administration and sales" account are related to the total manufacturing cost in order to establish the [illegible]-charge (6.5% per cent) to be applied to the costing of the intermediate [illegible] products sold (tops and fabrics). For the administrative overheads, the same treatment is applied to all the remaining examples.

The wool-combing department processes 10,000 kg of raw wool (price: 20.-) [illegible],000 kg of tops. Only 2,500 kg of tops receive further treatment by the enterprise. The remaining quantity is sold to another company.

The spinning department manufactures 2,000 kg of yarn from 2,500 kg of tops produced in the wool-combing department. The output is used by the weaving department, together with additional 4,000 kg of yarn purchased from outside.

Relative to the weaving department, the wool-combing department is over-[illegible] and the spinning department is under-[illegible]. However, it so happens that the available purchase price of yarn is equal to the cost of yarn internally produced and there is a market for the surplus tops. Therefore, the enterprise has strong incentives for correcting the existing imbalance between the three processing departments.

10 per cent profit margin and 5 per cent turnover tax are assumed in determining the "calculated selling prices".

/...

(A: Spinning and weaving mill)

SCHEMATIC COST STATEMENT

COST TYPES	TOTAL	COST CENTRES: Wool-combing departm.	Spinning departm.	Weaving departm.	Administration and sales dept.
Material costs					
Raw wool	(200,000)	(200,000)			
Yarn	(200,000)			(200,000)	
Personnel costs					
Wages	16,000	4,000	2,000	10,000	
Salaries	23,600	4,800	1,000	5,000	12,800
Capital expenditures					
Imputed depreciation	114,000	22,000	30,000	60,000	2,000
Imputed interest	11,400	2,200	3,000	6,000	200
Imputed risks	17,800	1,800	2,000	14,000	
Service charges					
Consultants	5,000				5,000
Postage	2,880				2,880
Electricity	11,000	4,000	2,000	5,000	
Taxes	15,000				15,000
Special sales costs					
Turnover tax	(35,000)				(35,000) 2/
TOTAL OVERHEAD COSTS 1/	216,680	38,800	40,000	100,000	37,880

1/ Include overheads only. Direct costs are indicated in parenthesis.

2/ This charge is proportional to the value of products actually sold within the accounting period.

Basis for computation of sur-charge:

		Manufacturing costs
	Manufacturing costs of wool combing department	238,800
+	Overheads of spinning department	+ 40,000
	Purchased yarn for weaving department	200,000
+	Overheads of weaving department	+ 100,000
=	Manufacturing costs	= 578,800

Rate of sur-charge for administrative overheads:

$$\frac{\text{Overheads of Administration and sales dept.} \times 100}{\text{Manufacturing costs}} = \frac{37,880 \times 100}{578,800} = 6.55 \text{ per c}$$

/...

(A: Spinning and weaving mill)

CALCULATION OF SELLING PRICE

WOOL-COMBING DEPARTMENT

		Total		Unit costs
	Input of raw wool: 10,000 kg à 20.-	200,000		
+	Total overhead wool-combing department	+ 38,800		
=	Manufacturing costs of wool-combing department	= 238,800		
	Tops produced		9,950 kg	24.-/kg

SPINNING DEPARTMENT

	Input of tops: 2,500 kg à 24.-	60,000		
+	Total overhead spinning department	+ 40,000		
=	Manufacturing costs of spinning department	= 100,000		
	Yarn produced		2,000 kg	50.-/m

WEAVING DEPARTMENT

	Input of yarn: 6,000 kg à 50.-	300,000		
+	Total overhead weaving department	+ 100,000		
=	Manufacturing costs of weaving department	= 400,000		
	Cloth produced		1,000 m	400.-/m

SELLING PRICES

A) Tops
B) Fabrics

A) Tops (7,450 kg)

	Manufacturing cost		24.-/kg
+	6.55 per cent administrative overhead sur-charge	+	1.57
+	Profit margin (10 per cent of the above total)	+	2.56
+	Turnover tax (5 per cent of selling price)	+	1.48
=	Calculated selling price	=	29.61/kg

/...

(A: Spinning and weaving mill)

B) Fabrics (1,000 m)

	Manufacturing cost	400.- /m
+	6.55 per cent administrative overhead sur-charge	+ 26.10
+	Profit margin (10 per cent of the above total)	+ 42.61
+	Turnover tax (5 per cent of selling price)	+ 24.64
=	Calculated selling price	= 493.35/m

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Example B: VEGETABLE OIL REFINERY

Oil-pressing is preceded by cleaning seeds, grains and other oil-carrying material to remove foreign matters and parasites. After the material has been shelled it is pressed and crude oil is extracted. In this particular process, 10,000 kg of raw material at 10.- per kg were processed, yielding 6,000 kg of crude oil.

Oil-refining is a process to neutralize oils, i.e. to extract free acidity, wash, bleach and de-odorize oils in order to produce edible oils. This cost center processes the total output of crude oil and produces the following amounts of three different brands of edible oils:

Brand A	3,000 kg
Brand B	1,000 kg
Brand C	1,000 kg.

The relative process time required to produce Brands A, B, and C is in the ratio of 5:4:1. Brands A and B are sold while brand C will receive additional treatment. The turnover tax amounts to 5 per cent of the selling price. A profit margin of 10 per cent is assumed.

The total output of brand C (1,000 kg) is further processed in the boiling department, resulting in 700 kg of final product. The profit rate as well as the turnover tax are the same as for products A and B.

The total oil-milling process is characterized by the fact that each department (= cost centre) produces one product only with the exception of the cost centre "Refining" which has 3 different types of output. Process cost accounting, similar to that shown in Example A, is applicable in this example, but for the cost centre "Refining", it has to be supplemented by job order accounting to establish relative production costs of the three brands of oils produced in the department.

As in the case of Example A the "Administration and sales" overheads are related to the calculated manufacturing costs in order to establish the rate of mark-charge to be applied to various marketable products.

/...

(B: Vegetable oil refinery)

SCHEMATIC COST STATEMENT

COST TYPES	COST CENTRES				
	TOTAL	Pressing department	Refining department	Boiling department	Administration and sales dept
Material costs					
Raw materials	(100,000)	(100,000)			
Auxiliary material and supplies	45,000	15,000	10,000	20,000	
Personnel costs					
Wages	468,000	190,000	180,000	90,000	8,000
Salaries	284,000	40,000		20,000	184,600
Capital expenditures					
Imputed depreciation	460,000	170,000	150,000	120,000	20,000
Imputed interest	82,400	30,000	30,000	20,000	2,400
Imputed risks	55,000	25,000	20,000	10,000	
Service charges					
Rent	40,000	20,000		20,000	
Telephone + Postage	25,000		10,000		
Taxes	40,000	10,000			30,000
Special sales costs					
Turnover tax	(85,000)				(85,000) 2/
TOTAL OVERHEAD COSTS 1/	1,400,000	500,000	400,000	300,000	260,000

1/ Summation excluding direct costs (parentherized figures).

2/ Accrual for the products sold during the accounting period.

Basis for compuation of administrative overhead sur-charge: **Manufecturing costs**

Total costs of pressing department		600,000
+ Overheads of refining department	+	400,000
+ Overheads of boiling department	+	300,000
= Manufacturing costs	=	1,300,000

Rate of administrative overheads sur-charge:

$$\frac{\text{Overheads administration and sales department} \times 100}{\text{Manufecturing costs}} = \frac{260,000 \times 100}{1,300,000} = 20 \text{ per ce}$$

/...

(B: Vegetable oil refinery)

CALCULATION OF SELLING PRICE

PRESSING DEPARTMENT

	Total		Unit costs
Input of raw material: 10,000 kg à 10.-	100,000		
+ Total overheads pressing department	+ 500,000		
= Manufacturing costs of pressing department	= 600,000		
Crude oil output		6,000 kg	100.-/kg

REFINING DEPARTMENT

Input of raw material: 6,000 kg à 100.-	600,000
+ Total overheads refining department	+ 400,000
= Manufacturing costs of refining department	= 1,000,000

Calculation for the costing of the three products:

Brand	Relative weight for costing	Quantities produced	Accounting units
A	5	3,000	15,000
B	4	1,000	4,000
C	1	1,000	1,000
			20,000

Manufacturing costs per accounting unit: $\frac{1,000,000}{20,000} = 50.-$

Manufacturing costs per kg of brand		Quantity produced	Manufacturing cost Refining
A:	50.- x 5.- = 250.-	3,000 kg	750,000
B:	50.- x 4.- = 200.-	1,000 kg	200,000
C:	50.- 1.- = 50.-	1,000 kg	50,000
			1,000,000

/...

(B: Vegetable oil refinery)

CALCULATION OF SELLING PRICES PER KG OF BRANDS A AND B

		A	B
	Manufacturing unit costs	250.- /kg	200.- /kg
+	20 per cent administrative overheads	+ 50.-	+ 40.-
+	Profit margin (10 per cent of the above total)	+ 30.-	+ 24.-
+	Turnover tax (5 per cent of selling value)	+ 17.37	+ 13.89
=	Calculated selling price	347.37/kg	277.89/kg

BOILING DEPARTMENT

	Input of raw material: 1,000 kg Brand C à 50.-	50,000
+	Total overheads boiling department	+ 300,000
=	Manufacturing costs of boiling department	= 350,000

Output: Quantity 700 kg
Unit cost 500.-/kg

SELLING PRICE OF BRAND C AFTER BOILING

		C
	Manufacturing unit cost	500.- /kg
+	20 per cent administrative overheads	+ 100.-
+	Profit margin (10 per cent of the above total)	+ 60.-
+	Turnover tax (5 per cent of selling price)	+ 34.74
=	Calculated selling price	694.74/kg

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Example C: SOAP FACTORY

This case is similar to Example B in regard to the costing of different brands of product produced in one department. It also resembles Example A in that an intermediate product is partly sold on the market, but this case needs a different treatment for the costing of the internally processed part of the intermediate product, since its marketable price is no higher than its manufacturing cost (excluding administrative overhead and profit margin).

The enterprise comprises two departments: refinery and cooling press/curd soap production. The refinery processes raw materials worth 200,000 into 10,000 kg of soft soap. 2,000 kg of soft soap is sold on the market. The selling price for soft soap is pre-fixed at 30.-/kg, which is no higher than the manufacturing unit cost.

The selling of soft soap at this price fails, therefore, to recover even the turnover tax and the administrative overhead charges. Thus, to shift this part of the cost burden to the subsequent processing department, the turnover tax (3,000) and 10 per cent profit margin (6,000) for the sold soft soap are charged against the manufacturing cost of the 8,000 kg of soft soap to be further processed internally. Since all this is intended to establish a correct selling price for the final products that can recover these "losses", the administrative overheads not recovered in the sales of soft soap is entirely absorbed in the costing of the final products.

Curd soap production utilizes the remaining quantity (8,000 kg) of soft soap, yielding 6,000 kg of curd-soap. Three types are produced. The process time required to produce Brands A : B : C is in the ratio of 3 : 2 : 1. The quantities produced are A: 4,000 kg, B: 1,000 kg, and C: 1,000 kg. Brand C is exported, resulting in extra packing costs of 2.- per kg. A 10 per cent profit margin as well as the 5 per cent sales tax are to be included in the prices.

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(C: Soap factory)

SCHEMATIC COST STATEMENT

COST TYPES	TOTAL	COST CENTRES: Refinery	Cooling and curd soap production	Administration and sales
Material costs				
Raw material	(200,000)			
Auxiliary material	35,000	15,000	20,000	
Supplies	15,000	5,000	10,000	
Electricity	36,000	10,000	25,000	1,000
Personnel costs				
Wages	85,000	35,000	50,000	
Salaries	132,000	5,000	80,000	47,000
Capital expenditures				
Computed depreciation	90,000	20,000	60,000	10,000
Computed interest	11,000	2,000	7,000	2,000
Insured risks	5,000	2,000	3,000	
Other charges				
Maintenance	11,000	6,000	5,000	
Rents	20,000			20,000
Taxes	10,000			10,000
Total selling costs				
Packing	(2,000)			(2,000)
Turnover tax	(35,000)			(35,000)
TOTAL COSTS 1/	400,000	100,000	200,000	100,000

1/ Excluding the direct costs (parenthesized figures).

2/ Corresponds to the actual sales proceeds during the accounting period.

Data for computation of sur-charge:

		Manufacturing costs
	Manufacturing costs of refinery	100,000
+	Overheads of cooling and curd soap production department	+ 200,000
=	Manufacturing costs	= 300,000

Rate of sur-charge for administrative overheads:

$$\frac{\text{Overheads administration and sales department} \times 100}{\text{Manufacturing costs}} = \frac{100,000 \times 100}{300,000} = 33\frac{1}{3} \text{ per cent}$$

/...

(Dr. Soap Factory)

[redacted]

[redacted]

	Total	Unit cost
Input of raw material	[redacted]	
+ Total overheads refinery	[redacted]	
= Manufacturing costs of refinery	[redacted]	
Quantity produced	[redacted] kg	[redacted]
Gross proceeds from soft soap sold (2,000 kg à $0.-)	60,000	
- Turnover tax 5 per cent	- 3,000	
- Profit 10 per cent	- 6,000	
= Net calculated proceeds	-51,000	

Manufacturing costs of soft soap to be further processed (8,000 kg)

Total manufacturing costs of refinery	[redacted]	
- Net calculated proceeds from sold soft soap	[redacted]	Adjust.
= Adjusted manufacturing costs	[redacted]	[redacted]

COOLING PLANT AND CURD SOAP PRODUCTION

Input of raw materials (8,000 kg of soft soap à 11.1)	[redacted]
+ Total overheads of cooling press and curd soap production	+ [redacted]
= Manufacturing costs of curd soap production	= 449,000

Cost allocation to three brands of product

Brand	Relative weight	Quantity produced	Accounting units	Cost curd soap production	Cost/kg
A	3	4,000 kg	12,000	359,200	89.80
B	2	1,000 kg	2,000	59,867	59.87
C	1	1,000 kg	1,000	29.93	29.93
			15,000	449,000	

Manufacturing costs per accounting unit = [redacted] / 15,000 = 29.93

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([illegible])

[illegible]

	[illegible]	[illegible]	[illegible]
...nufacturing unit costs of cost-copy production	[illegible]	[illegible]	79.93
per cent administrative overheads	+ 26.94	+ 17.96	+ [illegible]
...fit margin (10 per cent of the above total)	+ 11.69	+ 7.73	+ 3.89
...ecial selling costs (packing for exports)			+ 2.—
...rnover tax (5 per cent on selling price)	+ 6.26	+ 4.32	+ [illegible]
...culated selling price	= 173.77	= 90.11	= 47.16

/...

Example 2: [illegible]

This enterprise has two process departments: esterisation and refinery. But these departments produce a variety of products. In such a case, the "process cost accounting" demonstrated in the earlier examples is not sufficient for product costing but it has to be systematically supplemented by "job order costing".

The cost statement, which covers the entire production lines of the enterprise, involves five cost centres, of which two relate to the "Electricity generation department" and the "Steam generation department", respectively. (Note that in the earlier examples "electricity" was treated as a cost category). To establish separate cost centres for these auxiliary production departments is particularly desirable since the rate of consumption of electricity and steam varies from one product (or product line) to another even within given process department.

The allocation of department overheads to specific products requires the identification of the magnitude of jobs performed on respective products in each process department. In this particular example, "production hours" are employed for this purpose in both Esterisation and Refinery departments. The overheads of the Electricity and the Steam departments are allocated according to kWh consumed and tons of steam consumed, respectively.

In the calculation of product cost-price, a demonstration is given with reference to only one of the various product lines in the enterprises, i.e. 100 t of raw ester (in the Esterisation department) which results in 90 t of refined alcohol (in Refinery department).

For this product line, the Esterisation department produces 100 tons of raw ester out of 75 tons of fat alcohol and 23 tons of organic acid. 95 tons of raw ester are refined; 5 tons of raw ester are stored for the time being (intermediate store). 32 tons of steam and 500 kWh of electricity have to be generated by the plant's own facilities. The process of esterisation takes 10 hours.

The Refinery then, processes the 95 tons of raw ester into 90 tons of refined products (alcohol), 85 tons of which are distilled, 5 tons being put in intermediate storage. 1.5 tons of soda lye (15.- per ton) and 2.5 tons of sulfuric acid (5.- per ton) are required in this process. The refinery consumes 25 tons of steam and 100 kWh of electricity. The refining process takes 8 hours. The prices of the refined products include a 20 per cent profit margin as well as the 5 per cent turnover tax.

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COST TYPES	TOTAL	COST CENTRES (a) Esterisation department	(b) Refinery	(c) Generation of electricity	(d) Generation of steam	(e) Administration and sales dept.
Material costs						
Raw material	(3,200,000)		- (3,200,000) -			
Auxiliary materials	200,000	100,000	100,000			
Personnel costs						
Wages	386,560	96,560	220,000	30,000	10,000	30,000
Salaries	1,150,000		180,000	30,000		940,000
Capital expenditure						
Imputed depreciation	1,420,000	230,000	540,000	450,000	200,000	
Imputed interests	190,000	50,000	60,000	50,000	30,000	
Imputed risks	90,000	40,000	20,000	10,000		
Service charges						
Maintenance	90,000			40,000		10,000
Cleaning	90,000	20,000	30,000			40,000
Rents	100,000		50,000			50,000
Telephone + Postage	250,000					250,000
Patents	(70,00)					
Taxes						
Property taxes, etc.	161,640				10,000	151,640
Special selling costs						
Turnover tax	(21,330)					(21,330) 2/
TOTAL OVERHEAD COSTS 1/	4,038,300	536,560	1,200,000	620,000	260,000	1,471,640

1/ Excludes the direct costs (parenthesised figures)
2/ Accrual to the sold output during the accounting period.

(D: Organic Chemicals)

Basis for job order accounting:

(a)	(b)	(c)	(d)	(e)
Production hours:	Production hours:	KWH:	Tons produced:	Total manufacturing costs:
1,900 hr	2,000 hr	1,000,000 kWh	20,000 tons	3,200,000

Rate of overhead charges:

(a) $\frac{\text{Overheads Esterisation}}{\text{Production hours}} = \frac{536,560}{1,900} = 282.40/\text{hr};$

(b) $\frac{\text{Overheads Refinery}}{\text{Production hours}} = \frac{1,200,000}{2,000} = 600.—/\text{hr};$

(c) $\frac{\text{Overheads Generation of electricity}}{\text{kWh}} = \frac{620,000}{1,000,000} = 0.62/\text{kWh};$

(d) $\frac{\text{Overheads Steam}}{\text{Tons}} = \frac{260,000}{20,000} = 13.—/\text{ton};$

(e) $\frac{\text{Overheads "Administration and sales"} \times 100}{\text{Manufacturing costs *}} = \frac{1,471,640 \times 100}{5,836,560} = 25 \text{ per cent.}$

* Total manufacturing costs:

Raw material	3,200,000
Patents	70,000
Overheads Esterisation	536,560
Overheads Refinery	1,200,000
Overheads Electricity	620,000
Overheads Steam	260,000
Manufacturing costs	5,836,560

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(D: Organic chemicals)

CALCULATION OF SELLING PRICE FOR RAW ESTER-ALCOHOL PRODUCTION LINE

ESTERISATION DEPARTMENT	Total	Input per ton of output	Value of inputs per ton of output
Input of raw materials:			
75 t fat alcohol à 200.-	15,000	750 kg	150.-
23 t organic acid à 150.-	+ 3,450	+ 230 kg	+ 34.50
	=(18,450)	= 980 kg	=(184.50)
+ Cost of energy:			
32 t of steam à 13.-	416	320 kg	4.16
500 kWh à 0.62	+ 310	5 kWh	+ 3.10
	= (726)		= (7.26)
+ Manufacturing cost of esterisation department:			
10 hr à 282.40	+ 2,824		+ 28.24
Manufacturing costs of 100 t of raw ester	= 22,000		= 220.—

REFINERY			
Input of raw materials:			
95 t raw ester à 220,-	20,900.-	1,055.55 kg	232.22
1.5 t soda lye à 15.-	+ 22.50	+ 16.67 kg	+ 0.26
2.5 t sulfuric acid à 5.-	+ 12.50	+ 27.78 kg	+ 0.14
	=(20,935.-)	=(1,100.- kg)	=(232.61)
+ Cost of energy:			
15 t of steam à 13.-	325.-	227.77 kg	3.61
100 kWh of electricity à 0.62	62.-	11.1 kWh	+ 0.69
	= (387.-)		= (4.30)
+ Manufacturing costs of refinery:			
5 hr à 600.-	+ 3,000.-		+ 33.33
Costs of 90 t of refined product (alcohol)	= 24,322.-		= 270.24

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(D: Organic chemicals)

	Cost per t of refined product	270.24
+	25 per cent administrative and selling overheads	+ 67.56
+	20 per cent profit (of the above total)	+ 67.56
+	Turnover tax (5 per cent of selling price)	+ 21.33
=	Calculated selling price	= 426.69

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Example E: SUPERPHOSPHATE PLANT

This enterprise produces normal superphosphates. This is the simplest case in all the five examples presented here. The output consists of one type. The different process departments have mutually balanced capacities so that there is no sale of intermediate product. Sulphuric acid, as well as raw phosphate, is purchased from outside.

This example gives, in addition to the results of the normal process cost accounting, a calculation of parameters similar to those used in job order accounting. For the purpose of costing the final product (normal superphosphate) this procedure is not quite necessary. However, those parameters might be considered as useful for inter-firm comparisons as well as for evaluation of the plant design and work organization.

The Grinding and sifting department processes 12,000 t (5.-/t) of phosphate rock, yielding 10,000 t of ground raw phosphate which is then processed in the decomposition chambers. 2,000 t of sulfuric acid is required for this process. The cost per ton of sulfuric acid is 10.-. After completion of this process the output weighs 2,000 t. 2,000 working hours were recorded during the accounting period.

This output is then crushed in the mixer and the drum. The running time of the plant amounted to 4,000 hours. Approximately 5 per cent of the material input is lost during this process.

The following milling results in an additional loss of 10 per cent. The running time of the mill was 3,000 hours.

Packing is done manually, wages amounted to 30,000 and this particular cost component is treated as "direct cost" in this case.

The selling price per ton of phosphate is to be calculated including a 10 per cent profit margin and the 5 per cent turnover tax.

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SECTION V: COST STATEMENT

COST TYPES	TOTAL	COST CENTRES					
		Grinding and sifting plant	Decomposition chambers	Baker and dryer	Mill	Packing	Administration and sales dept.
Material costs							
Raw phosphate 1/	(60,000)	(60,000)					
Sulfuric acid 1/	(20,000)		(20,000)				
Auxiliary materials and supplies	2,100	500	400	600	200	100	300
Personnel costs							
Direct wages 1/	(30,000)					(30,000)	
Supplementary wages	10,000	4,000	2,000	200	1,500	2,300	
Salaries	85,700	4,700	3,400	700	2,900	5,000	9,000
Capital expenditures							
Imputed depreciation	53,000	7,000	10,000	13,000	3,000	25,000	
Imputed interests	3,000	700	1,000	1,300	300	2,500	
Imputed risks	5,000	2,000	1,000	2,000			
Service charges							
Rent	3,000						5,000
Packing material	8,000					6,000	
Electricity	11,200	1,100	2,200	2,200	1,100	4,100	500
Other costs							
Taxes	30,000						30,000
Non-manufacturing selling costs							
Turnover tax 1/	(15,000)						(15,000) 2/
TOTAL OVERHEAD COSTS	158,000	20,000	20,000	20,000	9,000	45,000	44,800
		(a)	(b)	(c)	(d)	(e)	(f)

1 Direct costs not included in "total overheads".

2 Norm: 1% of the sold output during the accounting period.

(E: Superphosphate plant)

Manufacturing overheads relative to performance:

	Performance	Overheads per unit of performance
(a) Grinding and sifting plant	Output 10,000 tons	2.-/ton
(b) Decomposition chambers	Machine hours 2,000 hr	10.-/hr
(c) Mixer and drum	Machine hours 4,000 hr	5.-/hr
(d) Mill	Machine hours 3,000 hr	3.-/hr
(e) Packing	Direct wages 30,000	150 per cent

(f) Administration and sales department:

Manufacturing costs:

Raw phosphate	60,000
Sulfuric acid	20,000
Direct wages	30,000
Overheads of grinding plant	20,000
Decomposition	20,000
Mixer	20,000
Mill	9,000
Packing	45,000
Manufacturing costs	224,000

$$\frac{\text{Overheads Administration and sales department} \times 100}{\text{Manufacturing costs}} =$$

$$= \frac{44,800 \times 100}{224,000} = 20 \text{ per cent}$$

/...

(E: Superphosphate plant)

CALCULATION OF THE SELLING PRICE

GRINDING PLANT AND SIFTING

	Total	Cost per t
Raw material: 12,000 t raw phosphate à 5.-	60,000	
+ Total overheads grinding and sifting plant (10,000 t of output à 2.-)	+ 20,000	
= Manufacturing costs of grinding and sifting plant	= 80,000	8.-

DECOMPOSITION IN CHAMBERS

Raw materials:		
10,000 t raw phosphate à 8.-	80,000	
2,000 t sulfuric acid à 10.-	+ 20,000	
+ Total overheads decomposition in chambers (2,000 hours à 10.-) *	+ 20,000	
= Manufacturing costs of decomposition in chambers	= 120,000	60.-

MIXER AND DRUM

Raw materials: 2,000 t à 60.-	120,000	
+ Total overheads mixer and drum (4,000 hours à 5.-) *	+ 20,000	
= Manufacturing costs of mixer and drum	= 140,000	
Input	2,000 t	
- 5 per cent loss of weight	- 100 t	
= Output quantity	1,900 t	73.68

MILL

Raw materials: 1,900 t à 73.68	140,000	
+ Total overheads mill (3,000 hours à 3.-)*	+ 9,000	
= Manufacturing costs of mill	= 149,000	
Input	1,900 t	
- 10 per cent loss of weight	- 190 t	
= Output quantity	1,710 t	87.13

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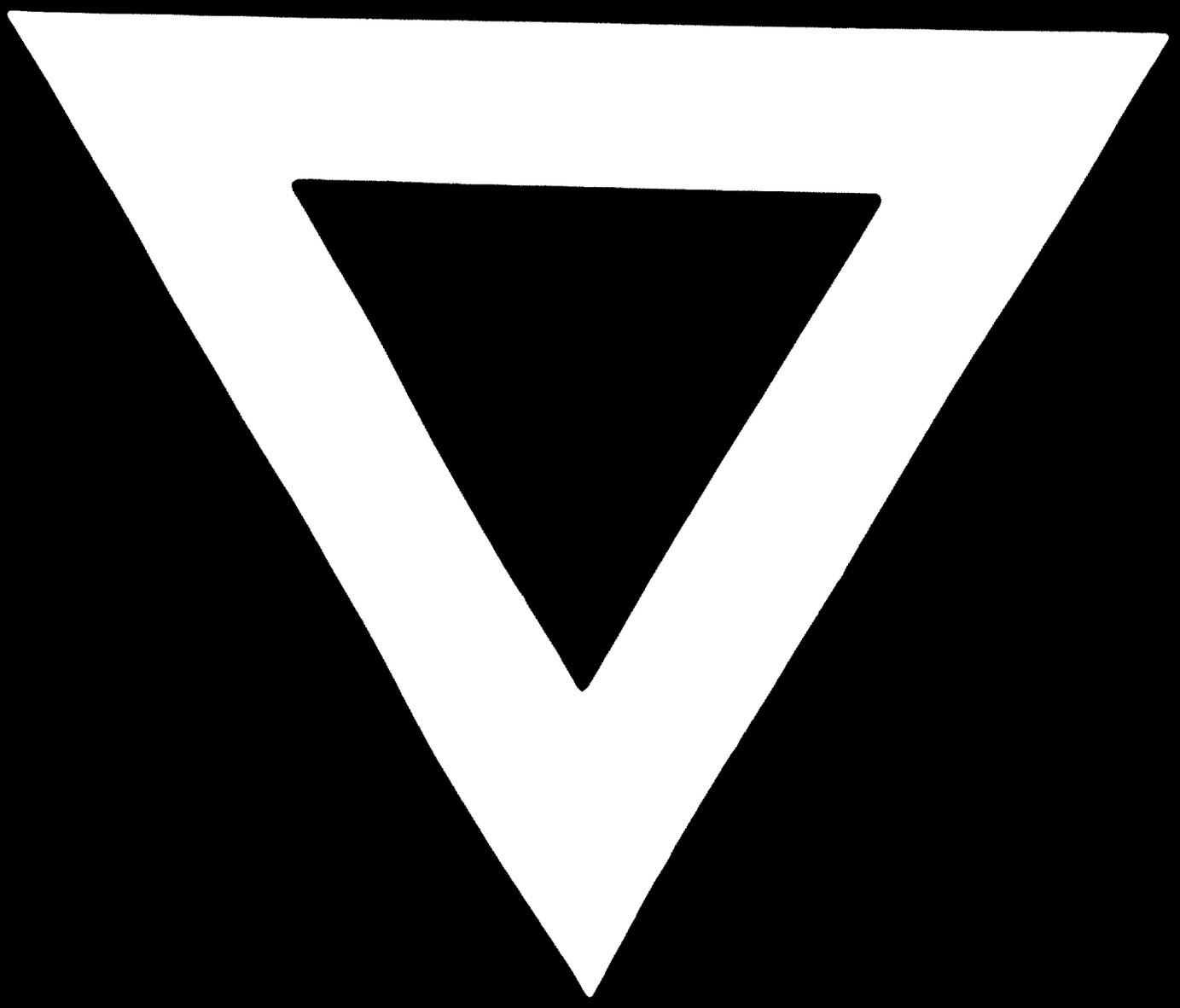
(2: Superphosphate plant)

PACKING

	Raw materials: 1,710 t $7.13	[illegible]	
+	Wages (direct)	[illegible]	
+	Total overheads packing (1.5 times of wages)*	[illegible]	
=	Manufacturing costs of packing	[illegible]	[illegible]
	80 per cent administrative overheads		[illegible]
	10 per cent profit margin		[illegible]
	5 per cent turnover tax of selling price		[illegible]
=	Calculated selling price		[illegible]

* As mentioned in the introduction to this example, those parameters which relate each department's overheads to its amount of work are not quite necessary in the calculation of unit costs in this example.

[redacted]



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