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FACTORS INFLUENCING LOGGING COSTS IN WEST AFRICA*

by

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1. Introduction

Forest exploitation is generally carried out by concessionaires in the private sector and it still remains the most important branch of the forestry and forest industries sector in the majority of developing countries. Local timber processing on the other hand, despite gradually becoming more widespread, is still often only of secondary significance. Since few plants in developing countries are specialised exclusively in timber processing, and integrated forestry and forest industries plants are predominant, forest exploitation has crucial significance for the wood supplier countries. In view of these facts it is not surprising that there is a constant discussion going on throughout almost all forestry and forest industries projects in developing countries featuring the logging costs, for, as such, these are of decisive significance for private and public sector investment, for setting the level of forest taxes and fees, concession profits, etc.

Although the logging costs are thus very important for both micro- and macro-economic decisions relating to the forestry and forest industries sector, so far there have been very few examinations and publications made on this subject which often contradict one another very obviously.

The aim of this present paper is therefore to show some of the factors and problems influencing the determination of logging costs, and to make proposals on ways of solving such problems. In this case "logging costs" are taken to be all costs (see Ch. 3.1.1.1) ranging from enumeration to transport up to the export harbour or processing plant. In the framework resulting from such a definition, problems and proposals can thus only be briefly shown by way of examples based on experience in West African wood supplier countries. The considerable differences between the individual producer countries also tend to demand this.

Therefore it is not regarded as the task of this discussion to calculate the absolute height of possible logging costs in various countries, but only to give helpful hints in the determination of the total costs for logging in African countries and in treating the total problem complex.

2. Influencing Factors and Problems

2.1 Examples of Variations in the Logging Costs*

With regard to the absolute height of logging costs in West African concessions there are little reliable data available so far. Most of the details which have so far been published originate from feasibility studies although it is not usually known whether in practice it will later be possible to produce at the given costs. To give an example two studies may be mentioned which give the following costs for logging free landing:

- $ 18 - 26/m³ in Congo (IBRD/FAO, 1976)
- $ 28/m³ (ATLANTA, 1977)

A very detailed calculation of the logging costs was made for example by JONES (1975) for Liberia based on model concessions and taking into account a wide variety of influencing factors. On this basis there resulted minimum costs of $ 17.51/m³ and maximum costs of $ 39.51/m³ (see Table 1).

Table 1
Logging Costs in Liberia ($/m³)

Phase of Operation	Duty Paid		Duty Free	
	High	Low	High	Low
Enumeration	0.39	0.20	0.39	0.20
Felling and bucking	0.68	0.51	0.64	0.48
Extraction	16.00	9.34	14.60	8.51
Loading	2.36	1.58	2.17	1.44
Road construction	7.69	0.55	7.69	0.55
Road maintenance	3.20	0.20	3.20	0.20
Administration	9.19	6.13	9.19	6.13
Total	39.51	18.51	37.88	17.51

Source: JONES, 1975

Apart from the details of the logging costs furnished by advisors, only rarely are data obtained directly from the concessionaires. For this reason a questionnaire was circulated in Liberia in 1977. This elicited concessionaires' logging costs vary between $ 19.80 and 124.00/m³ free

* All details in this chapter are based on logging costs free landing excluding fees and taxes because owing to considerable fluctuations in the fees and transport costs it would not otherwise be possible to establish viable comparisons.

landing, whereby however over 70 % of those approached gave responses within the range of costs found by JONES. These figures are confirmed by ad hoc sample investigations made among various concessions on the Ivory Coast revealing costs vary between $ 20 and 37.20/m³.

In addition to all the examples so far given, which contain to varying degrees a theoretical deduction of the costs, or have originated from private companies and cannot be verified, it must be observed that in the case of two companies in West African countries detailed examination of their cost accounting as part of certain consultancy projects gave average logging costs of about $ 20 and $ 31/m³.

The above examples point out considerable divergencies among the logging costs free landing whereby the majority, however, occur between $ 20 and $ 40/m³. From experience gained in West African concessions the variations among these logging costs can largely be traced to two sets of factors:

- Factors specific to country or concession such as wage levels, standards of training, etc.
- Unrealistic details given by private companies from a lack of exact calculation material or in order to conceal their actual rate of profit.

Detailed analyses have shown that the latter item frequently poses the reason for extremely high costs. Even if such unrealistic figures are omitted from the calculation, the logging costs still show a wide range of spread and it is to be attempted below to indicate the causes of this.

2.2 Influencing Factors

The total logging costs of which various examples were given in Chapter 2.1 reveal by nature even in accurate calculations certain differences owing to a wide range of factors. Such factors can basically be arranged in two main groups:

- Cost types which through their particular sort and level affect the total logging costs and can be directly quantified, e.g. wages, fuel costs, etc.
- General influencing factors which affect the individual cost types and cost centres. In some cases these cannot be quantified at all (e.g. organisation) and in others they can only be indirectly quantified (e.g. periods of operation).

The former influencing factors are not to be discussed in greater detail in this connection since they are basically quite well known and moreover are treated in the section on proposals (see Ch. 3).

The number of general influencing factors mentioned under the second point is extremely large so that any comprehensive enumeration and discussion is difficult, especially since they are often very interwoven. An example will serve to illustrate this: the influencing factors named by JONES (1975) for his calculation of the logging costs in Liberia (see Table 2). Here on one hand very special factors such as the density of undergrowth are taken into account, although other important factors such as the standard of training are omitted.

A detailed enumeration of all influencing factors would exceed the scope of this paper. Therefore only certain factors are described and discussed in more detail to provide suitable examples. For this purpose only such factors are chosen which appear to have particular significance or often come into discussion since in general they are difficult to quantify, if at all. Of those factors which can be quantified, only depreciation is actually discussed since this represents a frequent reason for variations in details given of the total costs for logging.

Table 2

Factors influencing the Logging Costs

	Felling Bucking	Extraction	Loading	Road transport
Tree diameter	x			
Buttressing	x			
Volume of logs	x	x	x	
Density of species	x	x		
Working hours per day	x	x		x
Terrain	x			
Density of undergrowth	x	x		
Transport distance		x		x
Maschine type		x	x	x
Organisation			x	
Road standards				x
Travel speed				x
Loading technique				x

Source: JONES 1975

2.2.1. Concession Location

The location of the concession can represent one of the crucial influencing factors in terms of logging costs because it implicates the dependence of a multitude of other factors, such as:

- Climate, which will tend to have an important effect on the annual periods of operation, costs of road building, etc.
- Terrain which will influence for example the degree of utility of the concession as well as road building
- Regional supply of labour and the existing material and personnel infrastructure; for example in remote concessions considerable costs can emerge through the fact that special measures have to be taken to obtain labour and provide social amenities.
- Transport costs: these represent the most important cost type in concessions located far from the sales market or the port of export.

2.2.2. Timber Species

An important factor in the logging costs are the properties of the timber species dependent upon location and species types, such as for instance trunk diameter (e.g. in Niangon and Sipo) and buttressing (e.g. Dabema), from which among other items the logging costs per unit volume will depend.

2.2.3. Standing Volume

With regard to the frequently practised system of selective logging generally prevalent in West Africa, it is crucial to know the standing volume as distributed over the exploited and exploitable species, i.e. those species termed "commercial species" rather than the total standing volume per unit of area. A particularly strong influence on the costs is the volume and number of trees per unit of area, i.e. the density of commercial species. For example, one Liberian concession selectively exploits high-value species such as Sipo, Makore, etc. at average costs of about $ 35/m³, although its costs in dense Tetraberlinia stands are only about $ 17/m³ despite the small trunk diameter.

2.2.4. Logging Volume and Equipment

The logging volume of a concession, i.e. for example the annual production volume, will naturally influence the absolute total costs, but a more important factor in this context is that it will also affect the costs per unit of volume. By contrast to the widely held opinion in West Africa, it is not the absolute output of a concession which is crucial for the logging costs

per unit of volume, but the degree to which the capacity of the necessary machinery is used: in other words the cubic metre costs do not sink in correspondence with the rising volume of logging, but rather the occurrence of sudden rises in the fixed costs need to be taken into special account. Investigations in West Africa have shown for example that these sudden rises in the fixed costs occur for instance when annual logging exceeds 24 000 m³ and 35 000 m³. This degree of capacity utilisation is often not taken into adequate account by public authorities and private companies. Thus for instance concession licenses are issued which owing to the size and potential logging volume will permit the logging of only a few thousand cubic metres. The volume costs in this type of concession are often extremely high, since the mechanical equipment cannot be operated to full capacity. Comprehensive investigations in Liberia have shown that some concessions currently use only 20 % of their possible capacity. Another factor influencing the costs in direct connection with capacity utilisation is the choice of equipment. It is essential to select the optimal technical alternatives, e.g. different systems of loading logging trucks and employment of wheeled skidders (which are often more suitable than crawler tractors). Moreover the range of equipment, particularly in smaller concessions, is not specialised enough. All-purpose machines are frequently employed, partly to ensure full utilisation of capacity and partly because investment is lower, but these show relatively poor performance and higher logging costs per metre as compared to specialised equipment.

5. Educational Organisation and Standards

The poor educational standard of employees and frequently also of the management may be considered a decisive factor influencing logging costs. In many concessions this is evident from the rapid wear and poor utilisation of machine capacity, big losses through waste and inadequate organisation of the flow of production. An essential step which seems necessary to reduce costs is to coordinate the individual parts of the logging operation better so that bottlenecks, poor utilisation of capacity and large wastage of timber do not arise.

A factor which is often underestimated as to importance is the influence of the training standards on logging costs: although the majority of concession agreements contain clauses imposing the obligation on concessionaires to train local employees, this training is often neglected both in public and private institutions. Through investment in training certain cost reductions

would be possible by virtue of the ensuing greater efficiency and at least in some cases through the substitution of expatriates, since they frequently involve a significant proportion of the staff costs

2.2.6. General Economic and Forestry Policy

The influencing factors most likely to be discussed are those which are founded on political decisions, whereby often only one aspect of the cost-inducing factors is voiced. This comprises for example the following obligations which arise specific to a particular country:

- Provision of comprehensive inventories
- Restriction of logging by total volumes, species, diameters, etc.
- Forest protection and reforestation measures
- Log export restrictions
- Construction and operation of schools, accommodation, hospitals, etc.
- Payment of profit tax, fees, etc.

Some of these measures can influence the logging costs to rise either directly or indirectly, whereby it must be considered, however, that in many of the West African countries special privileges are also granted, such as:

- Tax incentives for a certain period of time
- Preferential customs tariffs
- Financial support, e.g. through particularly favourable loans obtained via development banks.

The investment activities and objectives which particularly with logging are much more marked than for instance in timber processing projects show that in the majority of West African countries there must still be sufficient profit-accumulation possibilities partly due to the investment incentives and despite the cost burden which in some cases is considerable. However, one problem is that political measures rarely take into account the imbalances within a country which are mostly caused through the particular location. Thus in remote forest areas for instance the logging costs are often considerably greater than in settled, opened up areas owing to the measures which are necessary to provide material and social infrastructure. Consequently up to now it is evident that regions as near to the coast of West Africa as possible have been exploited and owing to the increasing lack of timber resources in these areas in general increases in the logging costs must be expected. To avoid such regional imbalance in economic development, particularly poorly sited ventures could therefore be specially supported. Appropriate measures

are for example direct subsidies, special log export quotas such as in Zaire or a graduation of the forest fees according to transport distance as in the Congo.

2.2.7. Depreciation

A special position among the influencing factors mentioned by way of example is taken by depreciation, since this is generally quantifiable. Nevertheless considerable differences are evident not only in the level of capital invested. For a calculation of the costs with the relatively high investment for logging operations in West Africa depreciation plays a decisive role. Frequently it represents the crucial factor for manipulation or differences between various enterprises. One reason for this is the methodology in calculating the depreciation value and the depreciation period. Often only those rates are known which are based on officially permissible depreciation periods, whilst the residual or sales value at the end of the depreciation period is not taken into account. If depreciation is calculated in accordance with the useful life, its proportion of the logging costs will however drop considerably.

2.3 Problems in finding solutions

From the detailed specification of the non-directly quantifiable influencing factors it is evident that the calculation and influence of the logging costs in West African countries is linked with many kinds of problems.

One basic problem consists in the fact that such influencing factors are tightly interwoven and affect the most varied sections of a concession as will be illustrated by the following examples.

2.3.1 Road construction and maintenance

This is a very important cost centre which cannot be influenced by the concessionaire. However, evaluations of West African concessions do show that particularly in the road building sector misplanning is a frequent occurrence. In the assessment large fluctuations must also be taken into account, e.g. through:

- climate;
- differences in the terrain, even within a single concession;

- partial transferability of the machines used in loading and extraction, so that for instance in cases of periodical low logging due to the market conditions a greater quantity of roads can be built;
- periodically varying need for roads due to species composition, additional work in the start-up phase of the concession, etc.

Just how the effect of road construction on the production costs can vary is shown by examples from Liberia where the costs for "roads" range from $ 0.75/m³ to $ 11.77/m³ logged timber.

2.3.2 Transport Costs

Various analyses in West African countries have shown that the transport costs vary not only absolutely in relation to the transport distance but also with reference to the relative costs per round trip mile (RM). Field research among various concessions yielded rates between $ 0.0364 and $ 0.10/RM. In all probability the variation can be traced to the different capacity utilisation of the vehicles (regarding time and loading). Also the transport costs are generally dependent on the following factors:

- roads
  - . standard
  - . distance
- type of vehicle
  - . costs
  - . payload
  - . speed
  - . breakdowns
- staff
  - . effective working hours
  - . driver's skill
  - . loading technique
- timber
  - . amount for transport
  - . weight

A further problem is the varying potential influence of individual factors. A first step to bring logging costs into a quantifiable framework consists in grouping the influencing factors according to the extent to which they can be controlled by the concessionaire. From the examples mentioned it is possible to deduce the following groups of influencing factors:

- Factors which can hardly be affected by the concessionaire such as standing volume per unit of area and type of terrain.
- Factors susceptible to influence such as unsuitable equipment, poor organisation and training, which are very important in West Africa.
- Factors which are based on political decisions such as fees, social contributions, investment incentives, and which can only be indirectly influenced by private companies through close collaboration with State authorities.

In this context it is largely thosefactors which are liable to direct influence through the concessionaire which are significant. The basic prerequisite for any control of the logging costs through the concessionaires is that the individual and total costs as well as the effects of various factors and measures on the costs are systematically calculated. The main problems or weaknesses of many concessionaires are based on the following subjects:

- The effects of individual investments are not known or are not calculated thoroughly enough. For instance frequently only small sums are invested in training althoughthe standards of training influence almost all cost centres. This is caused by the fact that such investments will be amortised over a somewhat longer period of time only. The effect of investments in the road construction and maintenance sectors is even more evident. Examinations in Liberia have shown that the concessionaires invest on average $ 6000/mile, although they are rarely able to perform timber exploitation throughout the whole year due to the poor condition of the roads. Hence individual concessionaires build above-average quality roads for about $ 9000 - 11 000/mile. They are then in a position to perform exploitation the whole year round so that the additional investment will in many cases be rapidly amortised.
- Many concessionaires do not carry out exact and comprehensive accounting and at most possess certain conceptions of individual cost types and a few cost centres which are relatively simple to delimit, e.g. that of "enumeration". Detailed observations on the total costs from which measures to control individual cost types and centres can be deduced are often totally absent or are not compiled and recorded systematically or completely. Thus aspart of a questionnaire one concessionaire gave the production costs shown in Table 3.

Table 3 Log Production Costs

Production Costs (Result of Questionnaire)	$/m³	%
Enumeration	0.62	1.9
Felling and hauling	9.34	28.0
Road building	7.20	21.5
Depreciation on main road	1.56	4.7
Administration,management	3.10	9.3
Legal fees, audit fees, directors fees	1.53	4.6
Interest on loans	1.11	3.3
Workshop and ancillaries	4.35	13.0
Office	1.05	3.1
Schools, medical and social facilities	1.55	4.6
Ground rent	1.10	3.3
Depreciation development costs	0.90	2.7
Total	33.41	100.0

Apart from the fact that this method of listing does not cover the total field involved by logging costs, it shows an additional, quite decisive shortcoming: namely that it combines details relating to cost centres (enumeration, felling and hauling, road building, administration, workshop, office, schools) and details relating to cost types (depreciation, fees, interest, social facilities, ground rent). Through this mixture of cost types and cost centres in the calculation there is the danger that on one hand costs may be duplicated in the accounting and on the other hand that certain costs may be omitted. In this way it becomes clear that the value of such a calculation is doubtful from the outset and the concessionaire eliminates for himself the chance of being able to assess his records in such a way that they clearly reflect the cost situation of his concession.

Thus in summary the following conclusions may be drawn from the present investigations:

- It is not possible for different concessions and countries in West Africa to make generally valid statements on logging costs because they are subjected to such a varying constellation of influencing factors.
- Many of the influencing factors which are all closely interrelated cannot be quantified directly.
- Even those influencing factors which can be quantified are not recorded systematically or completely in many of the logging plants in West Africa.

These facts must be regarded as one of the important causes of the great variety of logging costs reported by concessionaires. In addition it is clear that concessionaires frequently underestimate the possibilities of controlling many of the influencing factors and thus the logging cost . The preconditions for such control in any case are measures in such fields as training, organisation and technical equipment. It is also necessary to systematically record and check the effects of the various influencing factors and this may only be possible via those factors which can actually be quantified, e.g. by introducing the methods of cost accounting as is customary in industrialised countries. Such methods as the compilation of operation sheets would increase awareness of cost control in the logging sector of West Africa and provide the concessionaires with basic material for investment decisions on possible investments, for measures to reduce costs, and also for negotiations with Government authorities in matters affecting forestry policy.

3. Proposal for Cost Accounting - Operation Cost Sheet

Below it is intended to outline a method capable of implementation with relatively little trouble which can facilitate the systematic compilation of factors influencing the logging costs and ultimately assessing such costs, namely the system of cost centre accounting with the operation sheet. Here the influencing factors are defined by the cost types.

Since the cost types which occur in the production sector "concession " are known in principle, it is not intended to go into a detailed explanation of them as such; the same is valid for the cost centres. However, in order to guarantee a uniform delimitation and definition of them, they are to be briefly outlined as to scope with an initial description of the operation sheet modified to fit the requirements of a concession operation (see Ch. 3.1.1). In order to illustrate these details, two concrete examples are to be given, i.e. two operation sheets of different West African concessions will be shown (see Ch. 3.1.3). Finally in Chapter 3.2 possibilities of using the operation sheet as an instrument of analysis are outlined.

3.1 Operation Cost Sheet - An instrument showing the influencing factors

3.1.1 Basic Characteristics of the Operation Cost Sheet in Logging Operations

On the basis of the concession businesses the costs incurred during one accounting period (generally one calendar year) can be distributed over the following types of costs and cost centres.

3.1.1.1 Types of Costs

The following types of costs (= influencing factors) are involved:

1. Personnel

- Salaries (staff)
  Payment to employees, including allowances, in so far as they make up a part of the periodical wage payments.
- Incidental payments (salaries)
  These include accommodation, removal costs, repatriation flight costs, compensation for objects damaged during duty, recreational activities, training and further training fees.

- Wages

  Wage expenditure for labour employed on staff including all basic wages and production bonuses.

- Incidental payments (wages)

  Obligatory and voluntary social expenses paid on behalf of staff for: support and benefits, allowances for special claims, mileage expenses, costs of training and further training, accommodation costs, medical expenses.

2. Materials

Acquisition and consumption of materials of all types in the course of production, including energy and water, fuels and factory supplies, office materials, road construction materials, etc.

3. Spare parts and tools

Due to the high proportion of total expenditure spares and tools are compiled separately from the costs for materials.

4. Postage and communications

Expenditure for domestic and foreign mail, air freight, telephone charges, expenses for in-plant communication (radio station).

5. Travel

Expenses for business trips domestic and abroad

6. Outside services and fees

Productive work and services rendered including the materials charged, including logging, transport, road construction companies, work by workshops and specialist ventures, costs for experts, for legal advice, for economic and tax advice, bookkeeping, etc.

7. Insurance and licences

Insurance premiums for buildings, inventory, machines, etc., liability insurances and drivers licence fees.

8. Rents

Rents for buildings and machinery, fees and contributions for the use of others' property (e.g. roads)

9. Contributions

Contributions to associations, etc. so far as they can be regarded as operating expenditure (e.g. concessionaires' association).

10. Bank interest

Interest payments to banks for loans.

11. Representation and directors' fees
Expenditure for representation and disbursements for directorships, etc. in connection with the venture.

12. Imputed interest
Imputed interest for the capital invested, buildings, machinery, spares and timber stock (generally calculated on the basis of the halved initial expenses)

13. Depreciation
Book value reduction of capital goods. The depreciation periods are subject to legal regulations, and for machinery the prescribed period is at present generally three years.

14. Other costs
Other costs which are not contained in the other costs listed above.

3.1.1.2 Cost Centres

The cost centres are divided by means of organisational and/or spatial criteria in order to form work sections. For the concession these sections clearly emerge from the work flow as follows:

1. Enumeration
All activities in the preparation for logging, particularly the annual felling plan and the total surveying and cartographical section.

2. Felling
All felling activities (felling, scaling, marking).

3. Extraction
Skidding of the timber from the felling location to the landing, partially with caterpillar or skidding vehicles.

4. Loading (at landing)
Crosscutting, scaling, marking of the logs, loading of the [illegible] for road transport.

5. Road construction
Construction of roads and bridges, timber yards and other infrastructural facilities.

6. Road maintenance
Maintenance of all infrastructural facilities.

7. Supplies
Transport of goods and persons, particularly fuel, construction materials and the delivery and removal of employees.

8. Workshop and parts store
Expenditure on these sections.

9. Transport
Transport of the round wood from the cost centre "loading" to the sawmill or port of shipment.

10. Administration
Costs of administering the venture excluding the buildings.

11. Buildings
Office premises, factory buildings (sheds, halls), and premises (work and accommodation) for the personnel.

12. Concession
All expenses not allowed for in the other cost centres.

3.1.1.3 Operation Cost Sheet

The above classification of costs into cost types and cost centres is combined in a table - the operation sheet - in which
- the cost types are listed in the side column, and
- the cost centres are listed in the column headings. (see page 18)

In accordance with this division, the costs for one accounting period are entered into this table and totalled in the last column and the last line. Thus the operation sheet embodies the following information:
- The totals column states the total costs of the concession for one accounting period, divided into cost types.
- The totals line states the total costs of the concession for one accounting period, divided into cost centres.
- The individual fields within the table show
  . the proportion of a type of cost taken by a cost centre when this proportion is referred to the corresponding column total, and
  . the proportion of a cost centre taken by a type of cost when this proportion is referred to the corresponding line total.

3.1.2 Allocation

Without going into a detailed illustration of the cost centre accounting, the allocation of cost types to cost centres is indicated in rough outlines.

It must be assumed that the costs of an accounting period (1 month, 1 year) are known as a total. These costs must be entered in the column entitled "Total" corresponding to their cost type (see example in Table 4).

After this first step these total costs must be distributed within the individual cost types, i.e. by line, over the cost centres. The criterion of allocation is the principle of causation, i.e. the question must be asked as to which cost centre the costs actually occur in. Cost types which cannot be partially or wholly allocated to a certain cost centre are compiled in a collective cost centre.

In a third step the individual costs must be added by cost centre, through which the total costs per cost centre are determined. These are shown in the totals line (see Table 4).

3.1.3 Ordering of the Influencing Factors by Examples

In order to illustrate the theoretical section, two operation sheets are shown. They give the costs for two different West African concession operations. Also the information possibilities of the operation sheet are indicated.

The basic data material permitted no details on the cost type "rent" and on the cost centre "transport"; also the cost centres "administration" and "buildings" had to be combined. Furthermore in Concession B there were no details available for the cost centres "supplies" and "concession" and the figures for road construction and maintenance were not shown separately. Therefore the two examples only give 13 and not 14 cost types and only 10 instead of 12 or seven instead of 12 cost centres respectively.

3.1.3.1 Operation Cost Sheet (Concession A)

As the first example the operation cost sheet I (see Table 4) is shown. As is valid for all other operation sheets the columns supply the division of costs in one cost centre or in the whole concession (see column "Total"), and the lines give the distribution of the individual cost types or of the total costs (see line "Total") over the cost centres.

Table 4 Operation Cost Sheet I - Concession A (values in $)

Type / Cost centre	Enumeration	Felling	Extraction	Loading	Road Construction	Road Maintenance	Supplies	Workshop	Administration/ Buildings	Concession	Total
Personnel	20 881	8 967	14 595	11 629	9 966	7 562	4 392	29 960	114 576		222 528
Materials		2 071	13 583	6 637	27 051	4 543	7 989	26 463	17 163		105 490
Spare parts	1 359	9 317	46 764	18 817	63 858	12 405	16 982	30 709			200 211
Postage									6 728		6 728
Travel									10 815		10 815
Outside services									16 783		16 783
Insurance										40 158	40 158
Contributions										350	350
Bank interest										35 045	35 045
Representation										5 012	5 012
Imputed interest										112 515	112 515
Depreciation	3 000	7 000	107 282	26 667	131 000	18 160	21 733	36 374	51 284		402 500
Other costs										9 815	9 815
Total	25 240	27 355	182 224	63 750	231 875	42 670	51 096	123 456	217 349	202 897	1 167 962

The costs occurring in the accounting period taken as basis make up a total of

$ 1.2 million.

This total cost is distributed over 13 cost types of which five bear the major proportions of 89 %, i.e.:

Cost types	$	%
Depreciation	400 000	34
Wages and salaries	225 000	19
Spare parts	200 000	17
Imputed interest	110 000	10
Materials	100 000	9
T o t a l	1 035 000	89

The remaining costs to the amount of $ 130 000 are distributed over the other cost types which vary widely in amount: The maximum/minimum values range between $40.200 for insurance (3.4 %) and $ 350 for contributions (0.03 %). The values of the cost types can be taken from the totals column.

Of the 10 cost centres, five (road construction and road maintenance are combined) make up 86 % of the total costs of $ 1.2 million:

Cost centres	$	%
Road construction and maintenance	275 000	24
Administration buildings	220 000	18
Concession	200 000	17
Extraction	180 000	16
Workshop	125 000	11
T o t a l	1 000 000	86

The remaining costs totalling $ 167 000 are distributed in a fairly low order of magnitude over the other cost centres. The value can be taken from the totals line.

3.1.3.2 Operation Cost Sheet II (Concession B)

The second example is operation cost/sheet II shown in Table 5. The costs for the production year taken as basis amount to a total of approx.

$ 400 000.

Table 5

Operation Cost Sheet II - Concession B (Values in $)

Type of cost \ Cost centre	Enumeration	Felling	Extraction	Loading	Road Construction/ Maintenance	Workshop	Ad-ministration/ Buildings	Total
Personnel	10 060	6 453	6 200	21 036	6 200	37 766	58 989	146 704
Materials		3 565	11 480	11 723	6 611	2 046	12 316	47 741
Spare parts	220	370	21 800	10 480	9 000	3 500	8 100	53 470
Postage								
Travel								
Outside services								
Insurance			4 000	2 000	4 000	2 000	5 000	17 000
Contributions								
Bank interest								
Representation								
Imputed interest	200	407	23 980	11 528	9 900	3 850	8 910	58 775
Depreciation	2 000	1 900	22 700	11 800	11 500	6 000	16 399	72 299
Other Costs								
Total	12 480	12 695	90 160	68 567	47 211	55 162	109 714	395 989

They are distributed over six cost types of which the staff costs and machinery costs (depreciation and spares) make up more than two thirds of all costs.

Cost types	$	%
Wages and salaries	147 000	37
Depreciation	72 000	18
Spare parts	54 000	14
T o t a l	273 000	69

The division of the remaining cost types (imputed interest, materials, insurance may be seen in the totals column.

Of the seven cost centres three bear more than two thirds of the total costs which amount to $ 400 000:

Cost centres	$	%
Administration (camp)	110 000	28
Extraction	90 000	23
Loading	69 000	17
T o t a l	269 000	68

The proportions of these and the rer ining cost centre may be seen in detail in the totals line.

3.2 Operation Cost Sheet - Instrument for Analysis of Influencing Factors

3.2.1 Basic Approach

In analysing the operation sheet there are basically two methods of approach:
- Analysis of the data within the operation sheet
- Analysis of the data with the aid of additional information.

The first approach analyses the influencing factors solely on the basis of costs and yields the following information:

1. The absolute level of costs
   . of total production
   . of individual cost types (as a total and per cost centre)
   . of the individual cost centres (by cost types and as a total)

2. The relative level of costs in percentages
   - proportion of the cost types in the total costs
   - proportion of the cost centres in the total costs
   - proportion of a single cost type in a cost centre as part of the total costs
   - proportion of all cost types in the costs of a cost centre
   - proportion of all cost centres in the costs of a cost type.

The second approach analyses the influencing factors by relating the costs to data which cannot be taken from the operation sheet. Here on one hand this may be figures which go beyond the accounting period covered by the operating sheet (e.g. invested capital), or on the other hand data may be used which are modified to the same accounting period such as for example the volume logged, the personnel employed, the kilometres covered.In this way figures can be found which give information on
- the total costs
- the cost centres
- the cost types
- each individual cost item.

As is clear from the above explanations there is little restriction to the analysis of the factors affecting logging costs in using the operation sheet, especially if data external to the operation sheet are included. The limitations are ultimately set by the concessionaire through the fact that he restricts himself to certain data which he regards as informative for himself and the concession operation.

3.2.2 Analysis of the Influencing Factors by Example

The possibilities of analysis are to be shown by three examples, i.e. a pure cost analysis and two analyses using date external to the operation sheet.

3.2.2.1 Pure Cost Analysis (Example: Operation Cost Sheet III)

The basis for this example is operation cost/sheet I of Concession A which was presented in Chapter 3.1.3.1. It includes the production costs which occur up to the point of transport from the plant. Thus the costs free landing of Concession A can be analysed. The percentages resulting from this calculation are compiled in operation sheet III (see Table 6).

Table 6

Operation Cost Sheet III (Costs free Landing in ✓)

Type of cost \ Cost centre	Enumeration		Felling		Extraction		Loading		Road Construction		Road Maintenance		Supplies		Workshop		Administration/ Buildings		Concession		Total %		Total $
Personnel	83	9	33	4	8	7	18	5	4	5	18	3	9	2	24	14	53	51			19	100	222 528
Materials			8	2	8	13	10	6	12	26	11	4	16	8	22	25	8	15			9	100	105 490
Spare parts	5	1	34	5	26	23	30	9	28	32	29	6	33	9	25	15					17	100	200 211
Postage																	3	100			1	100	6 728
Travel																	5	100			1	100	10 815
Outside services																	7	100			1	100	16 783
Insurance																			20	100	3	100	40 158
Contributions																			0	100	0	100	352
Bank interest																			17	100	3	100	35 045
Representation																			3	100	1	100	5 012
Imputed interest																			55	100	10	100	112 515
Depreciation	12	1	25	2	58	27	42	7	56	32	42	4	42	5	29	9	24	13			34	100	402 500
Other costs																			5	100	1	100	9 815
Total %	100	2	100	2	100	16	100	6	100	20	100	4	100	4	100	11	100	18	100	17	100		
Total $	25 240		27 355		182 224		63 750		231 875		42 670		51 096		123 496		217 349		202 897				1 167 952

First of all a calculation is made of the proportion of the cost centres and cost types in the total costs of 1 167 952 $ (= 100 %); the results are taken from the total column "Total %" (cost type proportions, Analysis 1) and the totals line "Total %" (cost centre proportions, Analysis 2).

In this way the analysis is done within the cost types and cost centres, firstly in order to ascertain how the cost centre costs are composed and what weight the cost types hold within one cost centre (Analysis 3). In operation sheet III this analysis is shown in the first line of figures of each cost centre. This means for example that the figure "83" in the cost centre "enumeration" means that 83 % of the costs of the cost centre have been used on personnel. Thus the personnel represents by far the greatest factor influencing enumeration.

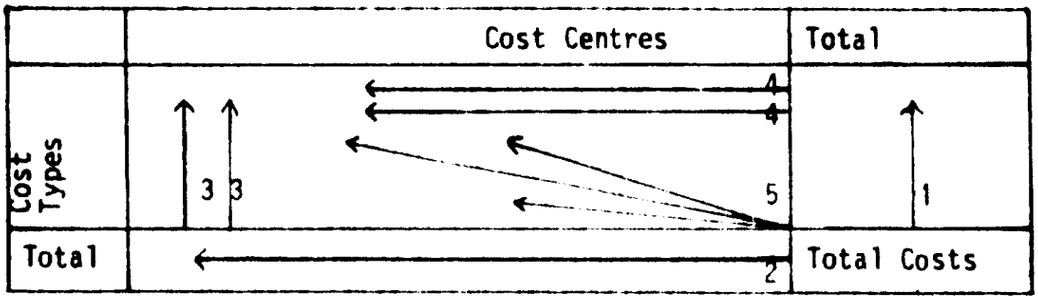
On the other hand it is ascertained how the cost types are distributed over the individual cost centres (Analysis 4). In operation/sheet III this analysis is compiled in the second figure which is enteredfor every cost centre. To bring this up to 100 % the figures must be added horizontally. An example will aid interpretation: the figure of "28" for the cost centre "road construction" means that 28 % of all expenditure in the concession was caused for spare parts in this cost centre.

Finally it is ascertained how high a proportion the individual cost types (in each cost centre) take of the total costs (Analysis 5). This analysis is not compiled in operation/sheet III. Elucidation may be found in the example of operation/sheet IV (Table 7).

These five ways of analysing the influencing factors by the operation sheet can be sketched in simplified form using arrows which show on which basis (= 100 %) the analysis proceeds, whilst the figures relate to the coming payment of the analysis and imply no urgent order of succession.

Figure 1

Possible Method of analysing an Operation Cost Sheet)



1: Distribution of the total costs over cost types
2: Distribution of the total costs over cost centres
3: Distribution of the cost centres over cost types
4: Distribution of the cost types over cost centres
5: Distribution of the total costs over the individual cost items

The question of which method to apply in practice depends on exactly what information the concessionaire wishes to obtain, e.g.

1: How high is the most expensive cost type in total?
2: Which is the most expensive cost centre in total?
3: Which is the most expensive cost type in the cost centre "loading"?
4: Which is the most expensive cost centre in the cost type "personnel"?
5: Which is the most expensive cost type of the total concession?

3.2.2.2 Analysis using External Data (Example: Operation Cost Sheet IV)

To give an example of an operation cost sheet analysis with the aid of additional data operation cost sheet I for Concession A and its annual logging of 35 000 m³(r) is used. The cost items shown in the operation cost sheet are all related to the production volume of 35 000 m³(r). The relative cost items resulting from the calculation in $/m³ are shown in operation cost sheet IV (see Table 7). To aid orientation as in the previous example again the absolute costs of the cost centres and cost types are used.

In accordance with the scope of the operation sheet I, operation sheet IV gives answers to the question of how high the costs per cubic metre produced of round wood free landing are, i.e.

- as a total ($ 33.37/m³)
- per cost centre ($ 0.72/m³ - $ 6.63/m³)
- per cost type ($ 0.01/m³ - $ 11.49/m³)
- per cost item ($ 0.01/m³ - $ 3.74/m³)

Table 7

Operation Cost Sheet IV (Costs free Landing in $/m3)

Type of cost \ Cost centre	Enumeration	Felling	Extraction	Loading	Road Construction	Road Maintenance	Supplies	Workshop	Ad-ministration/ Buildings	Concession	Total $/m³	Total $
Personnel	0.60	0.26	0.42	0.33	0.29	0.22	0.13	0.86	3.27		6.39	222 525
Materials		0.06	0.39	0.19	0.77	0.13	0.23	0.75	0.49		3.01	105 490
Spare parts	0.04	0.26	1.34	0.54	1.83	0.35	0.48	0.87			5.71	200 211
Postage									0.19		0.19	6 728
Travel									0.31		0.31	10 815
Outside services									0.48		0.48	16 783
Insurance										1.15	1.15	40 158
Contributions										0.01	0.01	352
Bank interest										1.00	1.00	35 046
Representation										0.14	0.14	5 012
Imputed interest										3.22	3.22	112 515
Depreciation	0.08	0.20	3.06	0.76	3.74	0.52	0.62	1.04	1.47		11.49	402 500
Other costs										0.28	0.28	9 815
Total $/m³	0.72	0.78	5.21	1.82	6.63	1.22	1.46	3.52	6.21	5.80	33.37	
Total $	25 240	27 355	182 224	63 750	231 875	42 670	51 096	123 496	217 349	202 897		1 167 952

3.2.3 Individual Analysis of a Cost Centre

Besides the total analyses indicated above special individual analyses of cost types and cost centres can also be performed. This is recommendable in particularly characteristic relation such as personnel costs and personnel numbers, depreciation and machinery, consumption costs and consumption volumes. Here a characteristic example is the cost centre "transport": for on one hand the log transport within the concession operation represents a special problem, and on the other hand it is here less the costs per m³ and rather - including consideration of the transport distance - the costs per m³ and km. Such an analysis could then include the data shown in Table 8.

Table 8

Transport Costs (in ¢ per m³ and round trip kilometre)

Types of Cost	Rate
Personnel	0.35
Materials	1.06
Spare parts	0.61
Insurance	0.12
Imputed interest	0.75
Depreciation	1.48
T o t a l	4.37

Therefore the transport costs of this concession over the accounting period total 4.37 ¢ for each m³ round wood which is carried 1 km. The largest proportion of this is represented by depreciation with 1.48 ¢.

3.3 Conclusions

It has been shown that the factors influencing logging costs can be compiled systematically with the aid of an operation cost/sheet. The analysis of the influencing factors based on this compilation can be carried out with or without data external to the operation cost/sheet. In this way there is a great number of possible ways of evaluation, the abundance of which is only restricted by the amount of information required by the concessionaire. This need for information in relation to the cost situation is, however, often not very characteristic, since

- in many instances the opinion is voiced that the trouble necessary for the introduction of a functioning accounting system (thus the operation sheet) is too great and even causes unnecessary costs;
- in the past, especially in the concession sector, in some instances relatively high profits have been attained rapidly which do not particularly encourage contemplation of costs;
- no external pressure was placed on the concessionaires to supply details of their costs.

All three reasons nevertheless rest on miscalculations or can change in the medium or long term for the concessionaire so that he is compelled to introduce the operation sheetsystem. However, in the interests of the concessionaires this situation should not be allowed to arise. An early introduction of the operation sheet as an instrument of management will ensure smooth and not overhasty (i.e. expensive) entry and will have amortised itself in relatively short time. Some examples follow:

- The operation/sheet gives information on the cost structure of the operation, i.e. in the analysis of a single operation/sheet there are already very important indications. If for example a cost centre alone shows a high percentage share of the total costs, then generally in this sector there exist the greatest prospects for tangible measures towards reducing the costs.
- A comparison of the various dependent figures can give valuable information. For example if two cost centres possess a similar set of equipment (which is shown quantitatively through the cost type "machinery" in the operation sheet), and if the respective cost type "spare parts" diverges greatly, the causes responsible for this can be specially searched for. Success will then be based upon the excessive costs for spare parts/which in one section can be reduced through special measures:for example by training to remove methods of operation.
- A comparison of operation sheets over a number of years will supply valuable hints on possible irregularities. For instance if for the past year it is ascertained that a cost centre for no obvious reason (e.g. special price rises) is clearly more cost-intensive than in previous years, internal reasons must be present. Again these may be levelled out through special measures (regrouping of staff, reorganisation).
- A comparison of the figures given in the operation/sheet with those for similar firms or only with rough figures (see Ch. 2.1) will give information on the relative competitiveness. If for example the cost centre "administration" clearly is higher than other administration cost centres, in general

a certain degree of inefficiency in this section must be concluded. The figures necessary for comparison will be relatively easy to obtain in an established branch of industry, whether through formal channels (e.g. international literature, information through associations) or through informal means (e.g. through fresh staff). The transfer of this structural data is in any case only the interest of all the ventures because in this way information useful to all is made available without making known certain business "secrets".

- Through a functioning accounting system the operation sheet will supply public authorities special individual items of information, which gain credibility through systematicalness and information content. Thus specially in a developing country which for instance is dependent on revenue through fees these fees cannot then be laid down purely arbitrarily. This is without doubt the case and is justified if an authority is confronted with logging costs lying between $ 20 and 120/m³ (see Ch. 2.1) which are only partially accounted for or even only represent an empirical value.

In a conclusion it is therefore clear that the operation/cost sheet is not an end in itself in its function of compiling the logging costs, but should function in the commercial interests of all concessionaires who are interested in the long-term prosperity of their ventures.

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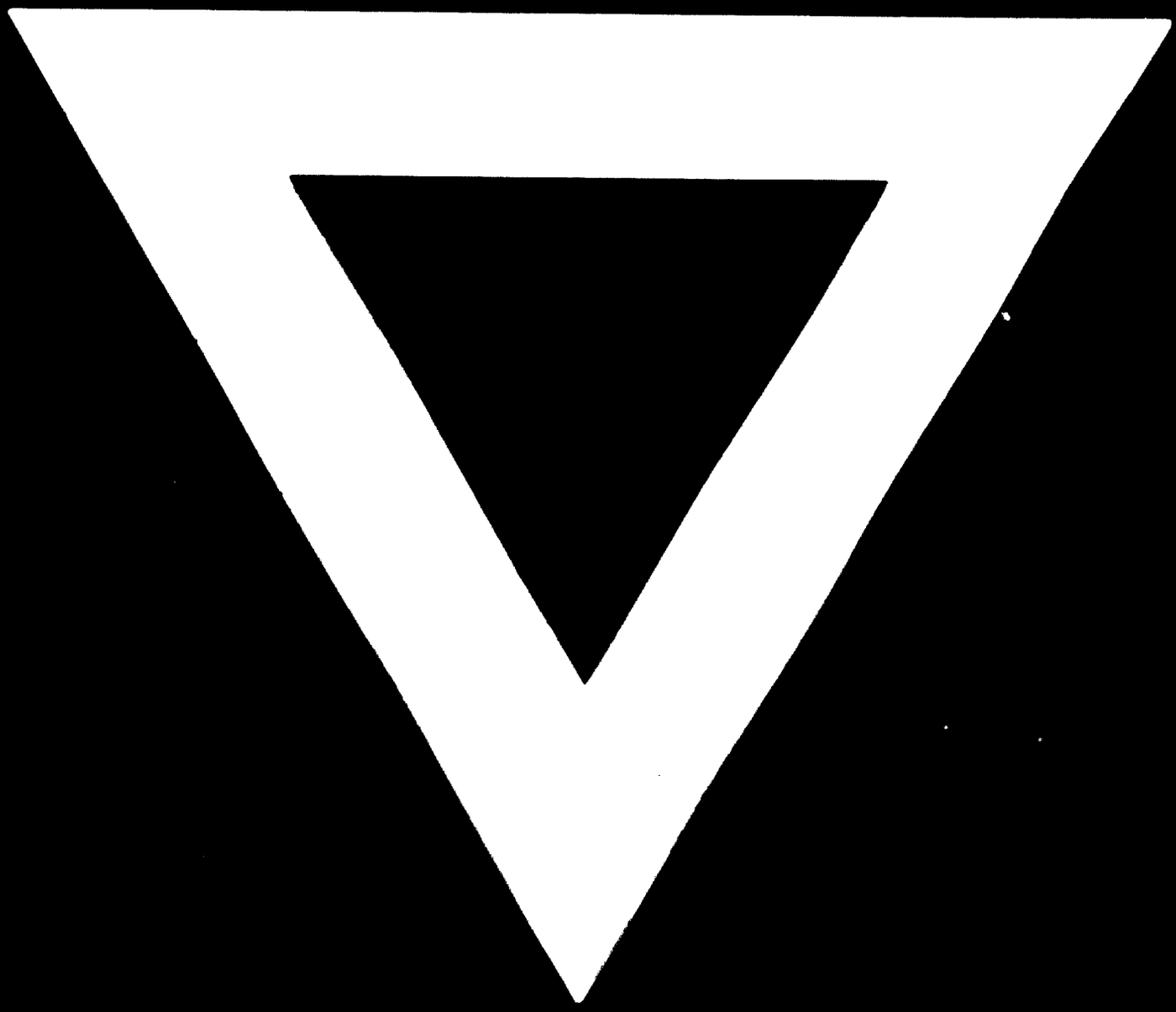

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