OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

04953

Distr.
LIMITED

ID/WG.157/9
3 August 1973

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

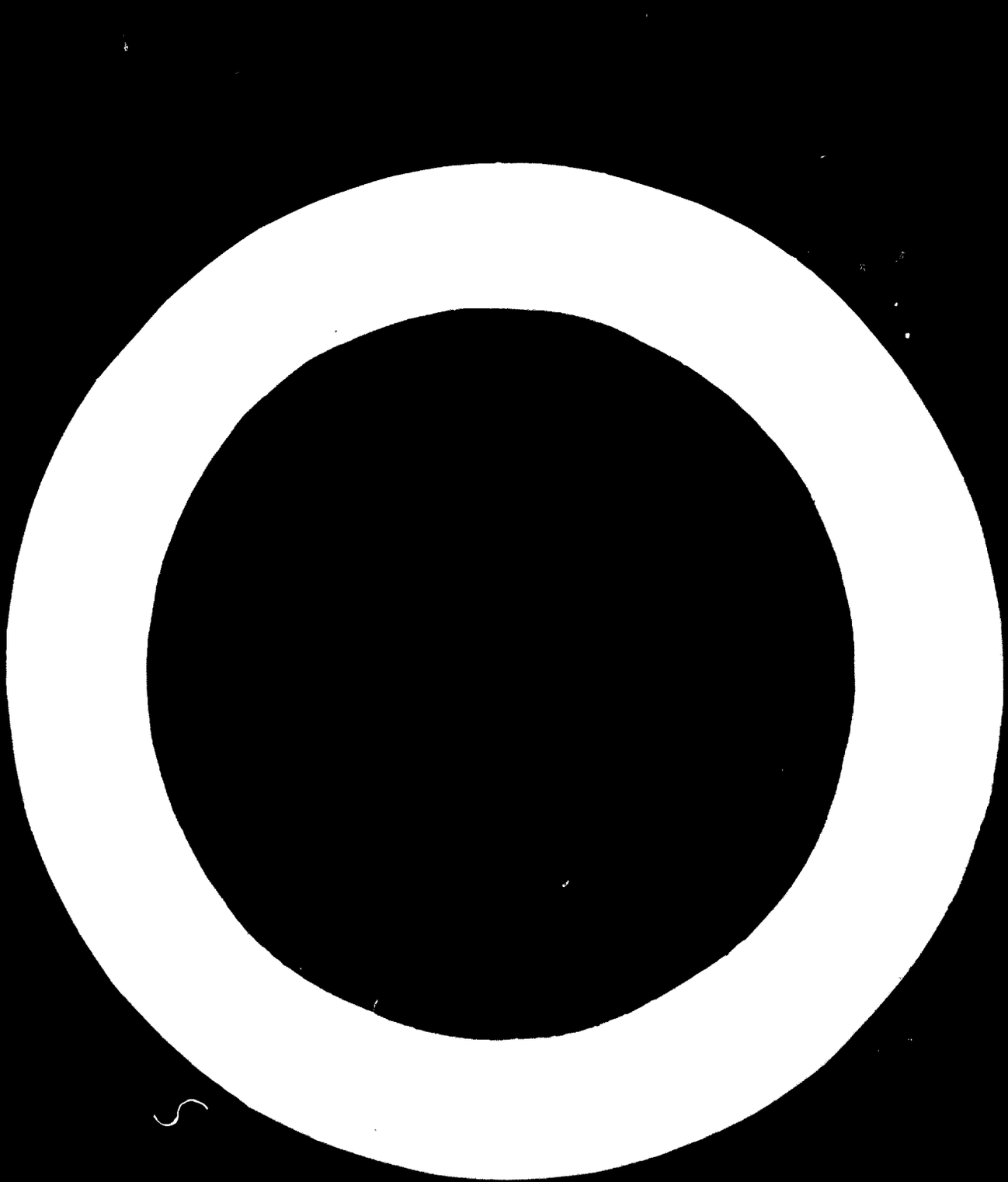
Workshop on Leather Industry Development
in Developing Countries
Regional Project for Europe and Middle East
Vienna, Austria, 27 August to 1 September 1973

A RAPID, ULTRA ECONOMIC PROCESS FOR PRODUCING SOLE LEATHER IN DEVELOPING COUNTRIES, IN ORDER TO AID THE SUBSEQUENT PRODUCTION AND EXPORT OF LEATHER SHOES[1/]

by

J. H. Atkinson
Wattle Export Development
London, United Kingdom

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.



A. INTRODUCTION

Many of the developing countries are today taking positive steps to maximise the "added value" content of their exports. In the Hide, Skin and Leather sector this has been apparent with the shift in exports from Raw Hides and Skins towards semi-processed leathers. This trend is fast accelerating, and many of the countries with Hide and Skin potential doubtless will quickly advance to the export of Fully Finished Leathers.

However there seems little doubt that in the coming decade strong efforts will be made to extend the logical process even further to include the production and export of leather goods - most probably leather shoes, which are today in such demand in the world markets will be the major exportation.

One of the major omissions in some of the potential producer countries concerned is the lack of suitable sole leather production units. The experience of Italy and Spain (the two countries which have shown the way in the export of leather shoes) has been that to obtain maximum value from their exports it was necessary to produce a 100% leather shoe (Leather Uppers with Leather Sole). Yet many of the countries which will soon be in a position to export shoes do not have the plant or technology to produce top grade sole leathers economically, although they may have capacity for upper leathers. Until this situation is remedied their progress to full economic utilisation of exports will be greatly hampered.

One realises that many of the developing countries have old established sole leather production units, but in most cases these have been aimed at producing material for the indigenous markets and this is not necessarily suitable for export as a component of a high value product, because shoes and other leather goods exported to more quality conscious markets need to be of higher quality.

The Authors believe that the process they outline in this paper will prove of much assistance in this situation, as it

allows production of top grade sole leathers using a simple process with a minimum of equipment. The process would seem well suited to new production units or existing sole leather producers. Also the process should prove suitable, with minor machine modifications and additions, for the production of vegetable tanned sole leather in existing chrome Upper Leather tanning plants.

B. OUTLINE OF ADVANTAGES OF SUGGESTED PROCESS

For many years tanners have discussed the speeding up of traditional processes. In the past, many of the rapid processes suggested have been workable, but have held little advantage for the tanner, due to the high cost of the chemical agents needed or over-complexity of the process. This paper however gives a simple economic process which can allow production of sole leather in less than half of the time normally required, using normal equipment, with the use of no expensive agents.

Advantages may be measured in two ways - to the individual tanner and to the particular countries' leather sectors economy, and it may be well to look at them separately.

It is shown that six major advantages accrue to a tanner:-

(1) Due to the speed and simplicity of the process it is easy to obtain identical properties in each batch of top quality leather, and it is also possible to adjust final properties of the leathers to obtain the desired properties for varying markets.

(2) Actual cost of chemicals and labour is reduced.

(3) Minimal equipment only is required.

(4) Speed of production allows flexibility in production whereby hides can be tanned against actual orders received.

(5) Capital cost of hides in tannery are reduced (Work in Progress), yielding lower cost of production.

(6) Effluent reduction.

It may also be shown that advantages accrue to the economy of the countries leather sector.

(1) Top grade sole leather may be made available for the export production of 100% leather shoes, thus allowing complete utilisation of available hides to produce high value, maximum added value, products.

(2) Capital requirement for the process is low, thus giving great scope to those countries where capital is not easily available.

(3) The vast majority of equipment required may be produced domestically, and only a few items would need to be imported. Thus reducing the foreign currency requirement.

(4) Effluent and water requirements are reduced, thus aiding environmental improvement.

C. THE PROCESS OUTLINE

Full details of the process are given in Appendix A (sufficient for any competent tanner to follow), but here we will give a brief outline only of the process so that one may appreciate its revolutionary nature.

Thus for medium to heavy hides we would suggest:-

Soaked	The hides are soaked normally (according to cure)	say	2 days
Lime	We recommend a Drum Process for		2 days
Delime	8 hours		
Pickle	4 hours		
Condition	8 hours (using only 10% Anhydrous Sodium Sulphate)		2 days
Pretan	6 hours (using 10% S.D. Mimosa)		
Main Tannage	18 hours (using some 20 - 30% S.D. Mimosa - Note I)		
Finishing and drying			6 days
	TOTAL PROCESS TIME		2 weeks

(**NOTE I** The amount of tannin added in the main tannage is dependent on the degree of tannage and firmness which is required in the resultant product.

NOTE II The process outlined has been well proven in practical trials, and is now in commercial daily usage in tanneries in at least two countries. The leathers so produced have been chemically and physically analysed by independent laboratories and found fully satisfactory and equal in all relevant properties to the products obtained by the longer traditional processes.)

D. DETAILED ADVANTAGES OF SUGGESTED PROCESS

I Effect of new process on Capital Cost

One may see that the process is completed within a 2 week cycle - this may be compared with the 4 weeks or more used in many Italian tanneries, and up to 12 weeks in sole leather yards in many of the developing countries. Time may in itself be of minor importance, but one must recognise that such a speedy process has advantages:

(1) Reduces "Work in Progress" and capital requirement - so important with current hide prices at extremely high levels.

(2) Allows increased production through existing plant or allows smaller new units to process larger capacities than would otherwise be the case for a given capital invested.

The astronomical hide price rises over the last 24 months have accentuated the capital demand position for many tanners - doubling of hide prices has caused many problems and what we suggest is that by halving "Work in Progress", by adopting a logical process, one can bring one's capital requirements back nearer to what was required before hide and leather suddenly became such expensive commodities.

Thus today we would say that the major justification for shortening process time is to lower capital requirement, which in itself reduces cost of production.

II Effect of New Process on normal Production Costs

It should be noted that the conditioner is an extremely cheap material, being generally available worldwide at around U.S.$ 50 ton. It should also be noted that we do not see the need or justification for many of the expensive proprietary chemicals which are often suggested in alternative processes.

In addition utilization of tannin is good, as the vast majority of tannins offered in the system are held by the pelt.

Having shown that the chemical costs should be far below those of any alternative rapid processes we would like also to mention that

handling is reduced to a minimum. From limed fleshed condition to fully tanned sole leather there is no need to remove the hides from the drums. Thus a saving in labour is obviously able to augment the savings in chemicals, leading to lower production costs.

III Effect of New Process on Production Flexibility

The proposed usage of ultra rapid drum processes gives many advantages in production flexibility:-

(1) Due to the short cycle of production, it is possible to control input of raw material to balance orders on hand. No longer must one have a pipeline of committed goods being processed irrespective of whether they are covered by orders.

(2) The process suggested is capable of producing many types of vegetable tanned leathers, a common process being employed right through to the pretannage. This allows choice of end product - and even selection into different end products at a late stage of process.

(3) As it is possible to dry the goods out after the primary tannage and hold in this "crust" state one can, if circumstances demand, hold stock and then wet back and finish into any type of sole or other leather as orders arise.

IV Effect of New Process on Reliability - Reproducibility and Versatility.

(1) The process being short and simple requires few analytical controls and thus gives good reproducible results - each batch like the next - which is not always to be said of the longer traditional process which, due to its longer time and increased variables, often shows variations from batch to batch.

(2) Alterations of % ton offer in final tannage and blend of this offering can allow the basic process to be used to produce any type and colour of sole leather, as well as case leathers and other similar vegetable leathers. Final ton offers (following a preton of 10%) from 18 - 30% followed by differing finishing allow this great versatility.

V Effect of New Process on Normal Water and Effluent Problems

(1) Effluent problems are greatly reduced:-

(a) only minimal quantities of float are used

(b) due to the process and short float condition uptake of tannin is good and tannin remaining unfixed in the final drum is negligible.

(c) while the 10% Sodium Sulphate will increase the salts content of the total effluent, the wash liquors do however have a low B.O.D. which is usually a major consideration. However, by suitably blending the sulphate wash liquors with the beamhouse effluent much of the sulphate can be precipitated in an insoluble form as calcium sulphate, thereby making a considerable reduction in the salt content of the effluent.

E PLANT, CAPITAL REQUIREMENT AND EXPORT POTENTIAL

As mentioned earlier the plant and equipment requirements for this process are minimal. In Appendix B we have attempted to outline the plant requirement to process 300 hides per day for Sole Leather (assuming 3/10 kg Dry Hide - 20 kg Soaked Hide) (a lightweight European side or a heavy African hide).

It is almost impossible to suggest actual plant and machinery costs or total project costs due to greatly differing circumstances in each country. Obviously there may be large differences between an operation by an individual entrepreneur or one by a quasi-Governmental body. Costs will be greatly effected by the ability or otherwise of the country to manufacture certain equipment (e.g. Drum bodies can often be produced at 25% of cost quoted by European Exporters.) Also willingness to accept high grade reconditioned machinery instead of new machines can reduce plant costs by up to 40%. Buildings also are subject to great variations in cost - often an indigenous type structure can be erected at nominal cost, whereas a steel/concrete structure will be many times more expensive.

Thus plant and machinery costs for the size of unit suggested could vary from U.S.$ 120,089 to U.S.$ 448,074. Total Capital costs could equally vary from U.S.$ 231,452 to U.S.$ 534,902.

For most developing countries the plant and machinery costs are the most important factors, as this is payable in foreign currency, whereas the balance of the requirements included in the total capital costs are usually payable in local currency which is not so difficult to obtain.

One could show the economic effectiveness of the suggested Project by assuming a plant and machinery foreign currency cost of U.S.$ 107,802. This could produce 300 hides per day which could perhaps, provide soles for 5,000 pairs shoes per day or 1,500,00 pairs shoes per year. These, if of medium quality, could obtain U.S.$ 5.00 per pair thus U.S.$ 7,500,000 per annum could be obtained in foreign currency - this figure is some 4 or 5 times greater than could have been obtained if the hides (for upper and sole) had been

exported raw.

N.B. It must be noted that in this example no account has been taken of the shoe machinery and plant costs as this is outside the author's expertise, but we feel it shows the great potential available for those who do aim to maximise domestic resources by producing and exporting the fully finished article, in this case the 100% leather shoe of medium to good quality, which is easily exported.

APPENDIX A

PROCESS DETAILS FOR ECONOMIC, RAPID SOLE LEATHER TANNAGE

(% calculated on limed pelt weight)

Soaking An efficient soaking is essential, particularly on dry and dry salted hides. An addition of ½ to 1% degreasent is recommended, especially on grease bearing hides.

Liming A two day drum liming, followed by fleshing, or a one day drum liming followed by fleshing and then a drum reliming, is the preferred process. It is possible to use other liming processes, but the important consideration in all cases is that it is essential to open up the structure completely.

Wash

Delime efficiently to pH 6.5 to 7 throughout the structure.

Drain

Wash

Drain well

Pickle

6% sodium chloride	drum ½ hour
½ to 1% sulphuric acid (98%))	drum 4 hours
½ to 1% formic acid (85%))	

The actual quantities of acids used depend on local costs but should be such as to give pH throughout the structure of round about 3.2 to 3.3. The acids should be diluted 10-fold before addition.

Drain well

Conditioning 10% anhydrous sodium sulphate drum 6 hours

At the end of this stage the pH should be 3.6 to 3.8 throughout the structure.

Tanning Add 10 - 15% Spray Dried Mimosa (quantity depending on the hide thickness)

Add 50% water	Drum 3 hours
	Drum 3 hours or until penetrated.

Wash 3 times in 100% water, each wash - drum ½ hour

Drain

Retan Depends on type of leather to be produced. E.g. for Sole leather add up to a further 30% Spray Dried Mimosa in one addition, drum 18 hours. Other types of leather, e.g. case and harness, will need different quantities of Spray Dried Mimosa. It is important that the drum

temperature does not exceed 40°C. and the drum speed should be such as not to exceed this.

FINISHING

The hides, after piling to complete tan fixation, are finished as normal:-

e.g. SOLE LEATHER:-

Washed

Sammed

Drum filled	3% Oil (Sulph. Fish: Mineral 1:1)	40 mins
	3% Mimosa	30 mins
	1% Filler (or 2% Epsom Salts + 2% Glucose)	30 mins

Hang to 1st Dry

Pile to Condition

Set Out

Redry to 30% Moisture Content

Roll

Redry

Reroll

Air Off

APPENDIX B

CAPITAL REQUIREMENTS FOR TANNERY TO PRODUCE 200 HIDES PER DAY - ACCORDING TO PROCESS GIVEN IN APPENDIX "A".

(The suggested 200-hides-per-day unit is perhaps the minimum economic unit and does not take full advantage of possible economies of scale for which one would need perhaps double this production.)

List of Basic Equipment

In order to show the great differences possible under different circumstances, and the effect on capital costs - especially foreign currency - we have shown two variants for the same sized production units these should both be capable of producing good grade sole leather.

Project A

Assumes that reasonable technical knowhow is available - and that maximum use is made of local production possibilities for such parts of the plant as is possible. The buildings etc. are utilitarian, but fully capable of housing safely the necessary plant and machinery. Such a project is suited to an individual entrepreneur, with experience in the industry, who would expect maximum return on his capital and do his utmost to keep capital costs at minimal levels, consistent with reasonable production. This project demands minimal foreign currency. This may be summarised as a "shoe-string" approach.

Project B

Assumes that the investor has not so strong an interest in profits (return on capital invested), but wishes a new plant, which takes other factors into account. It assumes at least some Governmental investment and reflects a desire for a prestige project. The capital costs given are those for a turn-key project. The cost reflects this approach.

N.B. There are obviously many intermediate possibilities between these two projects for different levels of investment, but it should be noted that the production would be virtually identical.

See Notes (a) to (o) attached at the end of this Appendix for explanation of the following tables.

Basic Equipment (contd.)

Item	No. Reqd.	Approx. Total Cost U.S. $ (Note f)			
		PROJECT A		PROJECT B	
(See Note a)		LOWER COSTED PROJECT using maximum local manufacture where possible and here applicable		NEW MACHINERY IMPORTED (See Note d)	
		Reconditioned Machines			
		Foreign Currency	Local Currency	Foreign Currency	Local Currency
SOAK DRUMS 3 m x 3 m	2	3,295	2,213 (note c)	17,070	
WHOLE HIDE FLESHER 3 m	1	29,466 (Note c)		49,110	
LIME DRUMS 3 m x 3.5 m	4	6,842	13,687 (note c)	37,140	
TAN DRUMS 3 m x 3.5 m	4	6,842	18,249 (note c)	50,070	
PALLETS for fork lift	10		1,250 (note b)	5,625	
SAMMYING MACHINE 2.75 m	1	13,446 (note c)		22,410	
SOLE SETTING MACHINE 1.8 m	1	17,216 (note c)		28,697	
OIL/FINISHING DRUM 3 m x 3 m	1	1,684	3,232 (note c)	9,285	
SOLE ROLLER	1	7,740 (note c)		12,900	
FORK LIFT TRUCK 6,000 lb. lift	1	6,300 (note c)		10,500	
RACKING FOR STORES 3 m x 3 m x 6 m			625 (note b)		1,250 (note b)
SCALES & TABLES, SMALL TOOLS ETC.			1,250		2,500
BOILER		(note g)		10,000	
SOAK PITS 3 m x 3 m x 3 m	3		1,250		2,500
OIL/WATER TANKS	Various		3,000 (note h)	15,000	
EFFLUENT PITS 30 m x 2 m x 3 m			1,000 (note h)		10,000
c/f		92,731	50,048	288,407	76,250

Appendix "B" Contd.

Item	PROJECT A LOWER COST PROJECT Expenditure in China		PROJECT B NEW MACHINERY IMPORTED	
	Foreign Currency	Local Currency	Foreign Currency	Local Currency
b/f	93,741	50,083	266,407	16,250
DRYING FACILITY (See note g)		1,250		2,500
WATER SUPPLY (See note i)		-	-	
OFFICE EQUIPMENT	500		2,500	
BASIC MAINTENANCE WORKSHOP LATHE & MILL etc. (See note j)	500		26,585	
	93,741	51,333	297,492	18,750
FREIGHT & HANDLING (See note k) say 20% on imported material	14,061	1,667	44,624	14,075
ERECTION & INSTALLATION (See note l) say 15% of total m/c costs)		21,702	23,710	23,718
PROVISION OF SERVICES		2,500 (note o)		25,000 (note o)
	107,802	80,287	365,833	82,343

		PROJECT A		PROJECT B
Total Cost of Installed Plant & M/C				
Foreign Currency	U.S.$	107,802	U.S.$	365,833
Local Currency	U.S.$	80,287	U.S.$	82,343
Total	U.S.$	188,089	U.S.$	448,176
Buildings (See attached plan) 1612 square meters (See Note m)	U.S.$ (Local)	43,363	U.S.$ (Foreign)	57,917
			U.S.$ (Local)	28,909
Thus Total Fixed Assets - i.e. Plant, Machinery and Buildings Erected & Services = Project Capital (See note n)				
Foreign Currency	U.S.$	107,802	U.S.$	423,650
Local Currency	U.S.$	123,650	U.S.$	111,252
Total	U.S.$	231,452	U.S.$	534,902

[illegible]

c Process equipment based on 20% hides per day at 20 kg soaked = 4,000 kg soaked hides per day.

h Cutting to cost of local manufacture.

i Cost of locally manufactured based on actual experience in an African country where facilities existed to cast iron work, form sheet bodies and only import motors and gearboxes.

d All new machinery, prices based on current prices of Messrs. Morris Industries - Birmingham, U.K.

e Assume a good second hand reconditioned machine is only 50% cost of new machine.

f £ Sterling to U.S. $ conversions have been based on £1 Sterling = U.S. $ 2.5.

g In many developing countries ambient temperatures of air and water are sufficient to allow processing and drying without external forms of heat. It may even be necessary to slow the rate of drying (3 - 4 days optimum) by use of enclosed rooms with louvres. Drying room of 20 m x 6 m x 3 m with 500 hooks or poles could handle 4 days' supply of hides hung two deep. Inlet air conditions circa 27°C - 60% RH.

h Effluent costs will vary greatly according to situation of tannery and degree of enforcement of local regulations.

i No cost can be estimated for water supply - one would assume either a metered mains water supply or available river or well water was available for more cost of pumping, but depends on location.

j In Case A it is assumed that local engineers are called in for any major repairs. In Case B it is assumed that all repairs could be carried out in the tannery workshop.

k Assume that of the 20% Freight and Handling cost,

10% is foreign cost

10% is local cost

l If skilled local entrepreneurs were initiating the project we could assume that all installation costs would be in local currency. If the enterprise were being initiated by non-technical investors and local expertise was limited we could assume that one-half of installation costs would be foreign (machine suppliers) and the balance local costs.

Notes on Annex to the Guide

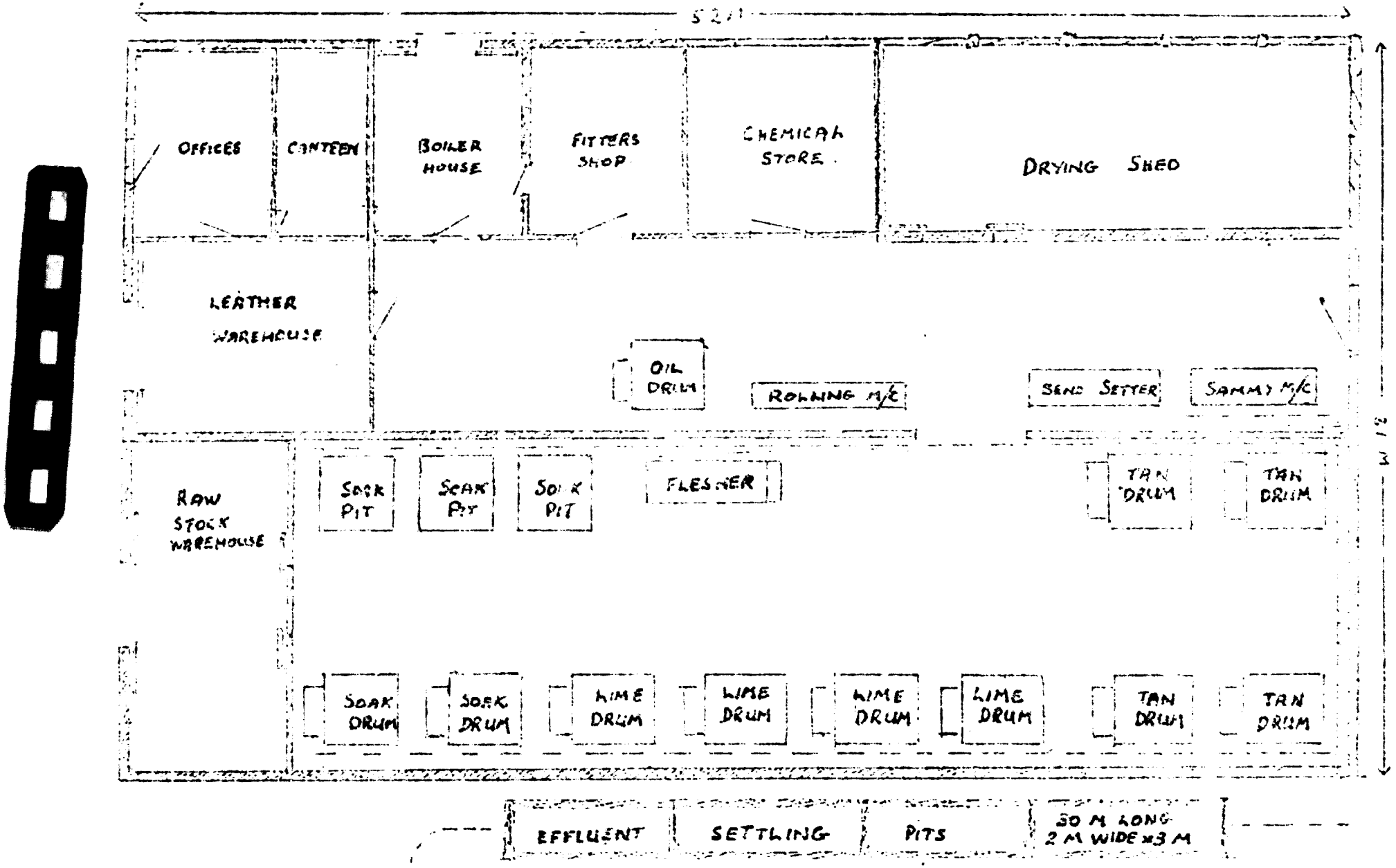
m A building fabric led from local brick and timber should not cost more than U.S.$ [illegible] per square m. - all of which is only a local currency requirement, and should prove suitable for Project A.

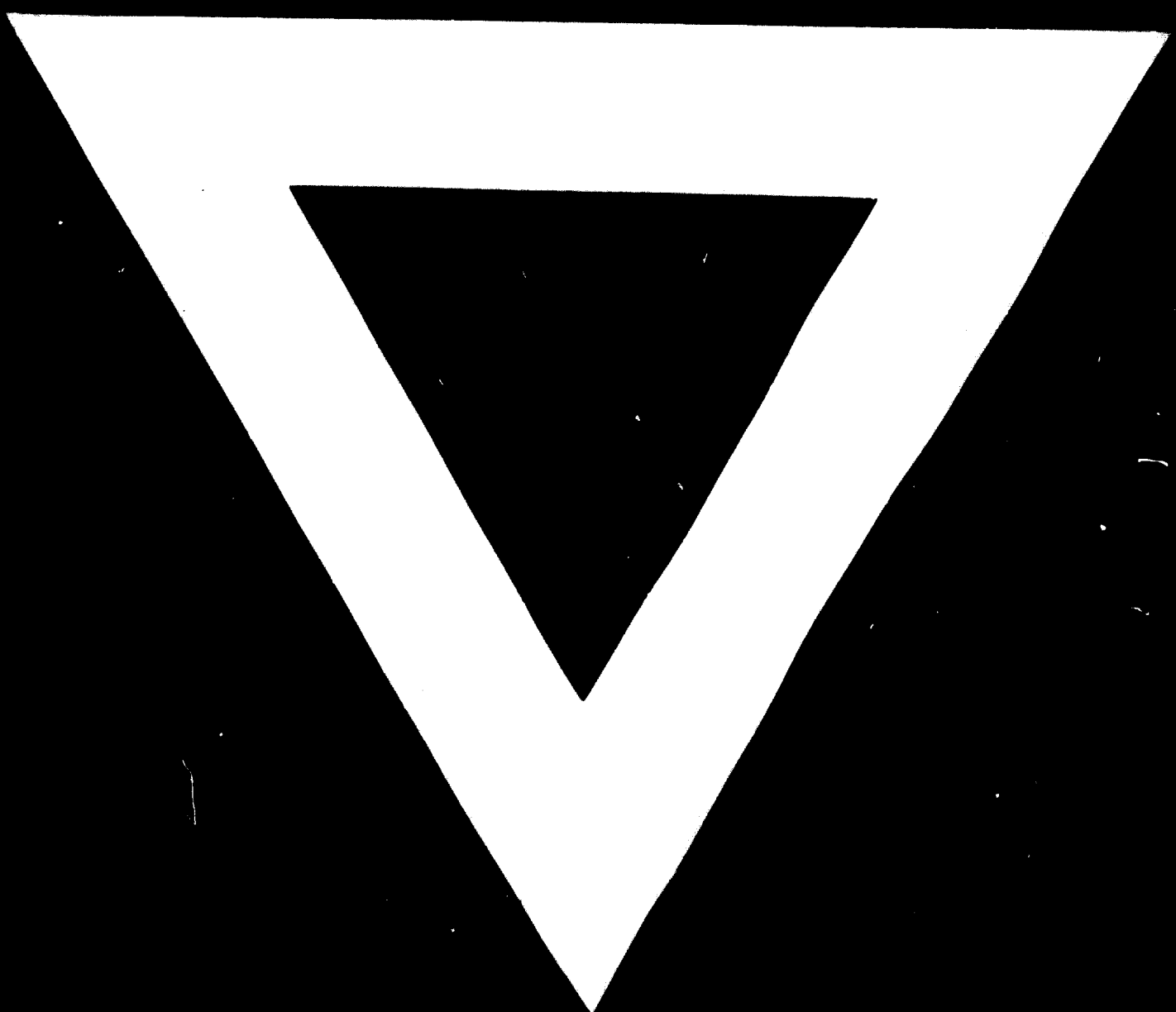
One would assume Project B would require local brick and imported light steel frame and asbestos at double the above cost (½ foreign currency - ½ local currency) i.e. U.S.$ [illegible] per square metre.

n Project Capital should obviously include further items i.e. TECHNICAL ASSISTANCE but we assume in Project A that this is available to the experienced entrepreneur - in Project B it should be available for machine supplier.

Also such items as "Working Capital" and "Work in Progress", "Chemical Stocks" should be included but they vary too greatly according to site and other circumstances to attempt any realistic estimate.

o Provision of services covers costs of piping and electricity supply to process equipment. It is assumed that supplies of electricity are available at the site, otherwise generation equipment will be needed.


52 M
OFFICES
CANTEEN
BOILER HOUSE
FITTERS SHOP
CHEMICAL STORE
DRYING SHED
LEATHER WAREHOUSE
OIL DRUM
ROLLING M/C
SEND SETTER
SAMMY M/C
RAW STOCK WAREHOUSE
SOAK PIT
SOAK PIT
SOAK PIT
FLESHER
TAN DRUM
TAN DRUM
SOAK DRUM
SOAK DRUM
LIME DRUM
LIME DRUM
LIME DRUM
LIME DRUM
TAN DRUM
TAN DRUM
EFFLUENT
SETTLING
PITS
30 M LONG
2 M WIDE x 3 M
21 M



G. 8. 74