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THE RESEARCH AND DEVELOPMENT OF LEATHER FOR
THE FOOTWEAR AND LEATHER GOODS INDUSTRIES
USING INDIGENOUS RAW MATERIALS ✓

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1. Introduction

In contrast to many synthetic materials, the raw hide is not a uniform, clearly definable organic substance. Its heterogeneous character with regard to chemical, physical, and structural properties gives rise to a variety of technical problems in the processing of hides into leather. Modern procedures and chemicals permit manufacturers to effectively control many operations in leather production and to obtain certain effects. Nevertheless tanners nowadays still have to rely on practical experience which they can only acquire in years of practical work, i.e. purely empirically. This is also one of the main reasons why the progress in the leather industry is rather slow in developing countries. On the other hand, countries like Argentina, Brazil, India, Pakistan, Spain, as well as other African and Asian countries, have proved that the shoe and leather goods industry can be brought up to a high technological level. Thanks to the efficient support of UNIDO and FAO, these industries were able to develop from pure trades into genuine branches of the economy truly meriting the name industry. Many countries of the Third World are still in the initial stages of this development. Others have proceeded further. In some cases there are signs of stagnation. Considering the high quality level and the exacting demands made by the consumers in industrial countries, the developing countries

will have to make every effort if their export goods are to meet market requirements. This task is not facilitated by the competition from synthetic materials for shoes and leather goods. To enable the countries involved to cope more efficiently with these and many other difficulties, it has frequently been suggested to establish national or transnational Leather Boards (1) (2) (3), which of course are very reasonable suggestions. Their realization, however, is an objective for the future. For the time being, we must concentrate on how to grapple with the existing situation. The purpose of this paper is to show the ways and means of doing this.

2. Prospects for a leather industry

2.1 Export

Developing countries generally strive to export a large proportion of their leather production. Besides quality requirements, long transport ways, currency fluctuations, customs formalities, fashion changes, and other factors frequently prove to be almost insuperable obstacles. But how can the industry of a developing country make progress if stable, long-term business with importing countries is not possible? I will try to find an answer to this question.

2.2 Home market

In view of the gradually rising standard of living in the developing countries, domestic demand must be expected to grow. Equipment for army and police forces also provides regular demand. A factor which must not be neglected is the increase in tourism to distant countries. Many tourists make use of the opportunity of buying low-priced leather articles. Italy, Spain, and North Africa are living examples for this trend. All this makes it absolutely necessary for the leather industry of a country to orient itself towards both export requirements and domestic demand.

3. Structure of a leather industry

3.1 Existing firms (tanneries)

They are located in towns or in their immediate neighbourhood. Mostly they are private owned or government controlled. Their state of development, the conditions of production with regard to financial situation, technology, and personnel are by far more favourable than those of small, remote firms without automation. The economic importance of the latter as a whole, however, must not be underestimated. For these regions frequently yield substantial quantities of raw material, primarily goat and sheep skins. Independent of whether the companies in question are large or small ones, contact and exchange with companies in Europe or the U.S.A. may nowadays guarantee more rapid progress, the main benefits being financial assistance and technical know-how.

3.2 New foundations

The economic, social, and geographic conditions in the respective countries are the decisive factors for the location of new factories. Water and energy problems will be dealt with later. The prospects for both existing and newly founded tanneries are good if one adheres to certain basic principles.

4. Raw material situation

Much was said about this at UNIDO meetings in 1971 and 1973 (4) (5) (6) (7). Although full credit should be given to new ideas and recommendations, it must be realized that fundamental changes in animal care, flaying of the hides and skins, preservation, trade, and the transport of the raw materials can only be effected very slowly in the foreseeable future. A shoe and leather goods industry capable of exporting will only be fit to cope with worldwide competition if it contributes to creating better conditions at the very basis. And this includes raw material as well as a properly functioning profit-making leather industry which manufactures products of sufficient quality in sufficient quantity.

4.1 Raw material from slaughterhouses

In slaughterhouses, flaying is generally done better than by butchers in remote regions. Sorting is easier and preservation is carried out more carefully. Part of this material can go directly to the leather factories to be processed without delay. Even if the flayed hides and skins are to be dried to permit prolonged storage, butchers should be made to observe uniform preservation, drying, and sorting instructions. In Ethiopia the result of such efforts was that their raw material fetched much higher prices due to improved quality (8). Therefore we feel that an improvement in the quality of raw material can more likely be achieved by motivating producers via higher prices than by recommendations or even subsidies from government authorities.

4.2 Raw material from home slaughterings

Home slaughtering is mainly done in rural regions inhabited by settlers or nomads. Certainly the total quantity of material obtained in this way will be substantial in many countries. But it is also certain that the quality of these hides and skins is generally inferior to those discussed under item 4.1. Presumably part of it is lost altogether. This is all the more regrettable as the raw material from the regions mentioned is predestined for the domestic leather processing industry, since under quality aspects, being wet blue or ready-to-finish material, it is less suitable for exporting.

4.3 Raw material / leather industry

An industry producing and processing leather is thus entirely dependent on and inseparably linked with its sources of raw hides and skins, i.e. it must make every effort to optimise and fully utilize these resources by efficient coordination.

This also makes clear why government and private initiative are so immensely important. Countries with free economic systems will experience much stronger competition in raw materials than ever before, since the objectives of those involved differ rather widely. Exporters seek their chances in Europe's importing countries, the U.S.A., and other parts of the world. Domestic wholesalers try to make their profits. Tanneries make direct arrangements with slaughterhouses. Existing leather factories may object to the construction of new leather factories. In short - many earn well. But those who take their animals to the slaughterhouse get the smallest share of the skin's value. This must inevitably lead to the conclusion that the authorities or persons in charge in the developing countries should ensure that animal owners are paid more money for the hides and skins they supply, for this would surely promote general interest in an improvement of the raw material. More money has always been the best incentive for higher efficiency.

5. Production planning

5.1 Sorting of the raw materials

Sorting of the raw material in the slaughterhouse or by trading companies, too, is not sufficient for the requirements of a leather factory. Each leather factory, even small ones, must do their own sorting of their hide stock in each individual case. The reasons for this are purely practical. Scientific data on the character of a country's raw material are of little value to those concerned with production. The percentage of certain proteins in a skin may be interesting to the scientists of an institute, but tanners have to deal with the raw materials delivered to them. This also applies to developed countries. A tannery would have to change its formulations daily if it had to take these things into account. Modern procedures permit the processing of even widely differing raw materials by making use of special, general-purpose products and operations.

5.1.1 Cattle hides

Material coming direct from the slaughterhouse cannot be stored more than 2 days in hot countries before they go into processing. If hides are stored for longer periods, damage due to bacteria is inevitable, which leads to putrefaction and thus considerably reduces the value of the goods. It is therefore advisable to start the liming of raw material on the very day it arrives from the slaughterhouse. Soaking may be omitted in this case, as a brief rinsing of the hides will be sufficient to remove blood and dirt.

The salted raw material should be sorted according to the weight of the individual hides. The weight can either be determined with a scale or with the trained eye of an expert. Before this is done, the material must be freed from the preservation salt not adhering to the hide or skin.

The following classification is recommended:

hides and skins up to	15 kg salted weight
hides between	15 and 25 kg salted weight
hides of	25 kg salted weight or above.

Sorting of this type can naturally only be carried out if a sizeable raw material stock is available. If sorting according to above criteria is not possible, coherent manufacture in a leather factory will be difficult to achieve, the result being fluctuations in quality. There are developing countries in which it has already become general practice to classify into cowhides, ox hides, bull hides, and buffalo hides, apart from the sorting into the 3 weight classes mentioned before. However, this division into hide classes is not imperative. Frequently sorting by weight is sufficient.

5.1.2 Calfskins / buffalo calf skins

Here, a classification into 2 classes will be sufficient, i.e.:

light and medium-weight skins of 3-7.5 kg salted weight
heavy calfskins of 7-12 kg salted weight.

Lightweight cattle hides, cowhides, and buffalo hides may also be included in this category.

5.1.3 Dried skins / dried calfskins

very light skins up to	2 kg dry weight
light skins	2.5-5.0 kg dry weight
medium-weight skins	5.5-7.0 kg dry weight
heavy skins	8.0-12.0 kg dry weight
superheavy skins	12.5-20 kg dry weight.

This category of skins differs only in water content. While the water content of salted raw material lies between 70 and 80 %, air-dried raw material has a water content of only 12-15 %. To avoid damage by putrefaction and bacteria, the water content in the latter case should not exceed 14 %. As the chemicals additions in the leather factory are based on the skin weight at the moment of input, it is important for the tanner to know without any doubt whether his formulation is to be based on salted weight or dry weight.

Procedures which disregard this factor are liable to impair the quality of the leather from the very start of processing.

The conversion factor is:

dry weight : salted weight equal to 1 : 2.0 to 1 : 2.5.

Examples:

A sun-dried skin of 1 kg weight corresponds to 16-20 kg salted weight. The quantity of nile substance is equal in both cases. Only the water and salt contents differ substantially.

5.1.4 Dried goatskins

In agreement with the customary practice on the world market regarding the sorting and quality description of this air-dried raw material, the following classification is recommended:

a) Sorting by weight:

light skins	9-12 kg dry weight per dozen
medium-weight skins	12-15 kg dry weight per dozen
heavy skins	15-18 kg dry weight per dozen.

b) Sorting by size:

small skins	3- 5 kg sq.ft. per skin
large skins	5-10 kg sq.ft. per skin

5.1.5 Dried sheepskins

The weight of an air-dried or salted sheepskin is mainly determined by the length of the wool and, with salted material, also by the moisture content of the wool. This means that the weight of sheepskins is not a reliable basis for the leather manufacturer. In the case of dry goods, it is much safer to classify according to the area of the individual skins.

Classification:

light skins	40-60 sq.ft. per dozen
medium-weight skins	60-80 sq.ft. per dozen
heavy skins	80-120 sq.ft. per dozen.

5.2 Suitability of the raw materials

5.2.1 Cattle hides

Hides up to 15 kg salted weight (approx. 6 kg dry weight) are best suited for the manufacture of upper leather for the shoe and leather goods industries. The same applies to the next weight class, 16-20 kg salted weight, with the difference, however, that leathers belonging to this group may also be used for the manufacture of sole leather. The third weight class of 25 kg salted weight and above is particularly suitable for the manufacture of sole leather, for these hides have the thickness required of sole materials and frequently have relatively severe blemishes on the grain side which are less conspicuous in sole leather than in upper leather. Of course this weight class may also be employed for production in the shoe and leather goods industries. Industrial countries are currently producing substantial quantities of clothing and furniture leather from this raw material, as large-area hides are the most favourable ones for this purpose. Naturally these hides are split into one or two layers during processing if these leather types are to be produced. The splits obtained are open to many interesting applications, including the production of upper leather, suede, lining leather, and similar leather types.

As far as the processing of medium-weight and, in particular, heavy raw material is concerned, the requirements for the domestic market of a developing country and the requirements for the market of an industrial country will thus differ rather widely. In a developing country, the production of shoes with leather soles for the home market will have little importance. Synthetic materials such as pvc and synthetic rubber will generally be used for this purpose. It will certainly be much more interesting for the economy of a developing country to produce as much upper leather as possible for shoes and leather goods from the hide classes mentioned before,

... will no doubt be sorted out and the better quality leather. The poorer quality leather should be sorted out and the lower quality leather should be used on the domestic market or exported to other countries for use as a second hand. Similar considerations should be made if supplies of reasonable quality are available.

The processing of buffalo hides, which are available in substantial quantities in many Asian and African countries, deserves special mention. These hides are generally heavy and large and the grain has big, open pores. The fibre structure is spongy. Nevertheless, it is difficult to produce soft upper leather from this material. The reason for this are the special properties of the buffalo hide. Another characteristic feature of the buffalo hide is that the removal of the epidermis is a very problematic operation. Aniline-dyed leathers generally show pronounced fluctuations in shape. For the processing into upper leather, buffalo hides are usually buffed deeply, then a relatively thick finish film is applied and a grain pattern embossed. This means that buffalo hides are less suitable for sportings, but should meet the requirements of the home market.

5.2.2 Goatskins

They are suitable for shoe upper leather, preferably those of aniline character. Medium-size skins and, in particular, large skins are also being used for the manufacture of clothing leather. Here, too, a distinction must be made between nappa (with grain) and suede (flesh side is important), depending on the quality of the respective side of the skin. Only the lower grades should be sorted out for shoe lining leather, as profits with this type of leather are low and, moreover, lower priced synthetic materials are frequently preferred as linings.

5.2.3 Sheepskins

Due to their loose, spongy fibre structure, these skins must generally be rated lower than goatskins. A special position, however, is occupied by the skins of young animals, the so-called lambskins. They are particularly suitable for gloving leather and therefore deserve special attention by the industry of developing countries. Light and medium-weight sheepskins are mostly unsuitable for shoes, especially if the leathers are to be exported. A shoe manufactured from this material would not keep its shape owing to the loose structure of the skin. The only applications in shoe production are as ornaments on ladies' shoes or for models which are equipped with a lining to impart more "body" to the shoe. In the field of clothing, however, and in leather goods, sheepskin leather is suitable for a great number of applications.

In addition, sheepskins offer interesting sales potential in fur processing. Possible uses include: leather garments, interior lining for winter shoes, gloves, floor coverings, car seat covers, etc. These examples indicate that there are many chances of promoting exports.

5.2.4 Game skins / miscellaneous

This collective name covers a variety of different hides and skins, such as antelope skins, zebra hides, tiger skins, lizard and other reptile skins. Antelope skins are generally processed with their natural fur. They are used for leather goods and partly also in the manufacture of shoes. Where they are becoming more and more popular, however, is with tourists, as souvenirs and trophies. Of camel hides, only certain parts are suitable for leather manufacture. The typical surface of the camel hide with all its bulging sections confronts processors with almost insuperable technical problems.

5.3 Trimming

This operation may seem of secondary importance to the layman. For both the tanner and the processor of finished leathers, however, it has always been a major problem. Those supplying the raw hides and skins tend to cut off as little as possible from the raw material in order to sell maximum weight or area. A leather producer, on the other hand, has completely contrasting interests. He would like to pay only for the skin area he can actually use and he wants to avoid that certain parts of the skin have to be cut off during the process of leather manufacture, as these parts would either be inadequate for the requirements of the respective end use or would be damaged during machine processing. Before input the following parts must be removed in each individual case: bones, horns, hoofs, ears, tail. They could damage the skins and the machines during soaking and liming or subsequent operations. The waste parts can be utilized for human nutrition or employed for industrial purposes. The liming process removes hair and wool from the skin. All hides and skins should be trimmed in the area around the knee and between forehead and shoulder, and, in the case of cowhides, around the udder. The utilization of these waste materials will be discussed later. At this stage an answer must be found to the question, in each individual case, whether hard currency should be spent for imported chemicals for the tanning of such hide parts. It was mentioned earlier that in the course of leather manufacture protruding extremities are liable to be damaged by machines and would consequently have to be cut off anyway. Importing companies cannot process poorly trimmed skins. It impairs their usually high productivity, quite apart from legal tangles which may arise if importers have to cut off the hide sections in question. This leads us to the conclusion that properly trimmed skins mean higher commercial value and facilitate the establishment of stable business relations with importing countries.

5.4 Production in existing tanneries

The processing or conversion of hides and skins into leather can generally be carried out in 3 groups of plants:

- a) in the chrome tannery,
with attached finishing department
- b) in the vegetable tanning department
- c) in plants for the tanning and finishing
of small skins.

a) covers the processing of all types of cattle hides and calfskins. The vegetable tannage b) must be kept completely distinct from the chrome tannage, in particular as far as the tannage proper is concerned. The pretreatment in the beamhouse for a) and b) may very well be carried out in the same room. But the processing of small skins according to c) is of entirely different character with regard to both equipment and processing technology, apart from the fact that the tannage of small skins requires much less investments than the other two branches of production. Such a tannery should be subdivided, in the field of tannage proper, into a department for chrome tannage and a department for vegetable tannage. Some skins could be processed in all three production units mentioned. If fur skins are to be processed, the setting up of a separate department is recommended.

It should be expressly emphasized that what was said in paragraphs 5.1.1 to 5.1.5 applies to all factories in developing countries. Whether big, medium-size, small, or very small factories are concerned, they all should, if at all possible, keep to the suggestions regarding weight or area when making up their batches. Such a classification is advisable if the machinery available is to be properly and efficiently used, and if the interaction between skins and chemicals is to be as uniform as possible. When consuming water or power, the costs involved should always be kept in mind.

and chemicals and the same naturally. As the raw material resources of a developing country as a whole constitute an important national source of income, long-term planning for the development of a leather industry will have to rely on intervention by government, government controlled or private instances if it should become evident after some time that valuable national resources are wasted due to inadequate management in the field of raw material supply and poor planning of leather production in the individual factories.

Another worthwhile consideration in this connection is whether small or very small factories should not merge voluntarily or with government assistance to form production groups. They could then improve their inferior position as compared with bigger and further developed factories by exchanging their know-how. Joint utilization of new machines, joint purchase of skins and chemicals, joint selling of semi-processed or finished products will certainly promote the development of these firms.

Such small factories which frequently are located deep in the interior of a country are frequently more efficient in utilizing the hides and skins available in certain regions. Processing of these hides and skins up to and including chrome tannage could also aim at selling this material to bigger, better equipped tanneries which have at their disposal manifold possibilities of further processing and marketing. For even the factories in the most remote rural regions will be capable of producing leathers of medium to good quality, at least up to and including chrome tannage, if they strictly observe some simple basic rules. Prerequisites for this, however, are that drums are available and that water and energy supply is guaranteed. What was said in the previous paragraph can relatively easily be put into effect at the planning stage. Water consumption, as was indicated before, is enormous. But the composition of so-called surface water

from rivers and lakes differs with the seasons. In addition, special importance must be attached to water hardness. This means that there may be fluctuations in leather quality within one year. We will return to this point later. Conditions are ideal if a factory has its own deep well, for this water is not subject to fluctuations and thus contributes to uniformity of leather production.

Generation of electricity by the factory itself would also be an advantage. Without a sufficient supply of warm water of a temperature between 40 and 60°C, high-quality leather cannot be produced (9) (10) (11) and enclosure 1. But there should also be the possibility of switching over to outside current in emergencies. If power or water are not available for some hours or even days due to a breakdown, severe, irreparable damage to the leather will be the inevitable consequence. Companies which have the equipment to generate steam must see to it that oil supplies are sufficient.

6. Production programme

The following points are important for the drawing-up and application of such a programme. See also enclosure 1. ?

6.1 The most important factors

- a) Are 1, 2, or 3 shifts worked?
- b) Actual working hours in an 8 hour day?
- c) Average loss of labour due to illness, personal or other reasons?
- d) Raw material input per day, expressed in skin weight or number of units? Output, expressed in sq. ft. or kg, which must be put at the disposal of the sales department per week or per month? This means that a production programme for at least one full week should be drawn up.

- e) The manufacturers must know the delivery dates for the finished leather.

The following principle has proved useful: the input quantity must be identical with the output quantity. This demand contributes essentially to continuous processing in leather manufacture, also with regard to quality. There must be no interruptions in beamhouse work and chrome tannage, while delays in later stages are less detrimental to leather quality. This compulsion towards uniform operation leads naturally to higher productivity, which in turn has a favourable effect on calculation and amortization of the plant. It is up to the individual factory to practice optimum economy and thus not only to make profits, but to pay all their employees higher wages and salaries.

6.2 Batch size

The batch size depends on the size of the factory, its machinery, its personnel, and the raw materials available, which was pointed out earlier. Guidelines: 25-50 skins per batch in a small factory, 50-100 skins per batch in a medium-size factory, and 150-200 skins in a big factory. Correspondingly, the batch sizes for sheep and goat skins are: 100, 250, or 500 skins per batch. These figures vary widely because the number and size of pits, paddles, and drums differ from factory to factory. It is much better to stop input for one or several days in case supplies are interrupted, for if batches vary in size, the chemicals additions must be adapted to this variation, i.e. weighing is required in each individual case. This is likely to cause mistakes or inaccuracies which then appear in the finished leather. If the batches are roughly uniform, use of a scale is always advisable, but not compulsory, provided the personnel is well trained.

Another problem is bridging the weekends. Batches must never be left in the soak or the liming liquor over work-free Saturdays or Sundays. If goods arrive at the end of the week, processing should proceed to a point where the material can be left in the pickle or chrome tanning liquor, since at this stage quality deterioration is much less likely. The right thing to do is to prepare the batches for the following week on Friday or Saturday, so that only a small number of employees is required on Sunday for carrying out soaking or liming. This guarantees that work in the following week can be taken up without delay. Similar measures are recommended in the case of prolonged stoppages: the batches should be brought at least to the chrome tanning stage. In the vegetable tanning, the processing of the skins should be carried on at least to the pretanning if any delays occur.

6.3 Providing chemicals

This important work should only be carried out by reliable persons. Errors or negligence will frequently result in inferior leather quality. The products should be stored in such a way that they are not exposed to rain, process water, or the sun, as this may considerably reduce their effectiveness. Where for internal reasons scales are used only rarely or not at all, certain containers distinguishable by size, shape, or colour may be employed, provided the batches, as was repeatedly stressed, are equal. In many cases it will be advisable to mark the containers for the individual products with signs, symbols, colour, etc. to facilitate the work particularly for completely untrained personnel and to guarantee uniformity of production.

What can be done if a product or even several products are no longer available? The plant manager in charge must know what products of similar character and with roughly the same

effect are in stock. Attention must be paid to the fact, however, that frequently the concentration, i.e. the content of active substance, is different, and that consequently the additions, treatment times, etc. must be determined separately for each individual case. Helpful information for such cases is that there are many general-purpose products with a wide range of applications. For example, there are synthetic tanning materials, fellinging agents, dyestuffs, and finishing agents, which may be used for both the chrome tannage and the vegetable tannage. This should be borne in mind whenever chemicals are purchased. If such products are available, less diversification is needed in the chemicals store and disturbances can be overcome more easily. But this already indicates that not each product offered at an apparently lower price actually has the required quality. It is in the very interest of each factory to purchase their chemicals only from those manufacturers who guarantee the uniform quality of their products and, in addition, have an efficient technical service.

6.4 Procedures

Proven formulations must be put in writing. They should not be changed without compelling reasons, and the factory manager and his deputy should be the only persons authorized to do this. The procedures must constantly be checked in order to prevent fluctuations. In addition, the persons in charge must always make sure that the imported products, for which hard currency was spent, are reasonably and effectively employed.

7. Processing

7.1 Chrome upper leather from cowhides

The following principle would be ideal: standard procedure from the soak to the chrome tannage, independent of the respective raw material with regard to race, average weight,

origin, etc. This makes human sources of error and quality fluctuations far less probable than when using several formulations of different character. With today's modern processes, this demand can very well be met.

At this point I would like to comment on the much discussed question about the influence of water on leather quality. The answer is that it plays practically no part in the beam-house work and in the chrome tannage. This means that it does not matter whether hard or soft process water is used for these operations. In subsequent processes, however, water hardness is an essential factor. But it can largely be eliminated by adding suitable products and employing appropriate procedures.

Timetable / batch of 150 salted skins

a) <u>WET BLUE</u>	<u>time</u>	<u>notes</u>
soaking	4-10 hrs.	water temperature approx. 25°C
liming	14-18 hrs.	incl. rinsing processes, etc.
fleshing	3- 4 hrs.	2 men/incl. cleaning of machines
splitting	3- 4 hrs.	incl. trimming of splits/maintenance
siding (x)	-	is carried out together with fleshing
deliming/bating	1- 2 hrs.	incl. rinsing processes
pickle	1- 2 hrs.	incl. checks
chrome tannage	<u>6- 8 hrs.</u>	incl. checks, unloading
total	<u>32-48 hrs.</u>	effective process time.

These processes are usually carried out in 3-4 work days.
1 work day = 8 hours.

(x): Facilitates further processing. May also be done after splitting.

<u>b) READY TO FINISH</u>	<u>time</u>	<u>notes</u>
sorting	1- 2 hrs.	according to grain quality/ thickness
shaving	4- 5 hrs.	generally distributed among 2-4 workers, consequently takes less time.
neutralization) retannage) dyeing) fatliquoring)	3- 4 hrs.	can be completed in 2 hours when using the "BAYER COMPACT" process
sanning	3- 4 hrs.	1 worker
setting-out	2- 3 hrs.	1 worker
drying	<u>5-18 hrs.</u>	paste, vacuum, suspension drying
total	<u>18-36 hrs.</u>	effective process time.

These processes are usually carried out in
3-4 work days.

General remarks:

- a) The formulations vary with the type of leather processed.
- b) The water hardness has an effect, which, however, can be corrected during neutralization and during fatliquoring.
- c) Allowances for the effects of climatic fluctuations (dry or rain period), water hardness, and softness of the leather can be made as in b), and in drying.

c) FINISHED LEATHER

storage	2- 4 days	work days
conditioning) staking)	2 days	work days
sorting) buffing) dust removal)	1- 2 days	work days
finishing	<u>3- 6 days</u>	depending on leather type and machinery
total	<u>6-14 days</u>	= <u>work days</u>

Summary

a) up to WET BLUE stage	3- 4 work days
b) up to READY TO FINISH stage	6- 8 work days (a) + b))
c) up to FINISHED LEATHER stage	12-21 work days (b) + c))
d) plus storage time between the individual processes, weekend delays, etc.	<u>5- 7 work days</u>
total	17-28 work days or
approx.	<u>21-32 calendar days</u>

These figures should only be considered guidelines. Time is an essential factor for the profits of a leather factory. The more rapidly and the more frequently the purchased raw material is converted into money, the more favourable will be the company's position with regard to borrowed capital (banks), interest payable on it, amortization, and depreciation. To provide a sound basis for this policy, the raw material stock should cover 2 months' requirements, and the chemicals stock should be sufficient for 3-4 months' work. Otherwise continuous operation would not be guaranteed. With dried skins, soaking takes 3-4 days, liming 1 day. In other respects, the timetable given in 7.1 applies.

7.2 Split utilization

Splits of various origins can frequently not be utilized due to poor flaying, poor preservation, insufficient thickness, etc. However, the splits obtained in a factory processing suitable hides constitute an interesting material for calculation, for exports, and the home market. Splits finished with pigment finishes are suitable for the manufacture of low-priced shoes and leather goods.

7.3 Dried goat and sheep skins

The most important applications have already been mentioned under item 5.2.2. In clothing, optimum softness is demanded of the material used. The fibre structure of goatskins, which

are hard by nature, must therefore be opened up to a considerable extent in the liming process. In addition, attention must be paid to certain factors in subsequent processing. As far as softness and stretch are concerned, leathers for gloves represent the extreme. These brief remarks explain why the formulations must be of different character from the very beginning, and this in turn is why it is so difficult to manufacture leathers of uniform quality in this field. Special attention must be attached to the removal of hair and grease residues from the grain layer, in particular if the material is to be exported. The chrome tanning material addition is roughly 1.7-2.0 % chrome oxide, on pelt weight. In dried leather (calculated on 14 % water content) an analysis should show a chrome oxide content of 3-4 %. The pH value should not drop below 3.5.

Timetable: up to wet blue stage approx. 12-15 work days.
Up to "ready-to-finish" stage approx. 16-25 work days.
Up to "finished" leather stage 26-40 days.

General remarks: Neutralization and retannage should be carried out with inclusion of synthetic tanning materials and special products. The skins may be dyed in a pale beige or medium brown to obtain a uniform shade. This is followed by a mild fatliquoring, drying, staking, and, if applicable, vacuum drying in combination with suspension drying. Subsequently, the skins are toggled on frames to level out any unevenness and to achieve a maximum area yield.

7.5 Sole leather

Time required for processing from input to output:

- a) old tanning processes: 2-3 months (suspenders/tanning drum)
- b) modern processes : 3-4 weeks (tanning drum only)

The possibilities of application, however, are limited in hot countries.

7.6 Buffalo hides

What was said before basically also applies here.

7.7 Fur skins / game skins

Here very specialized procedures are required which I do not want to discuss in detail now.

8. Checking

8.1 Checking of batches

The individual skins of a batch should be stamped with the batch number. This is not required for small skins. If possible, so-called batch cards should accompany the skin batches through all processing stages. Sorting after liming and chrome tannage automatically divides up the input batches, and the resulting new batches should then also be marked with stamps or batch cards. These measures facilitate the passage of the batches through all stages of manufacture. In addition, calculation is made easier. And there is yet another important factor: properly marked semi-processed or finished leather can be used to evaluate the quality and uniformity of the raw material obtained from the individual suppliers. In this way the leather manufacturer can indirectly contribute to a better general treatment of the raw material before it is handed over to him.

8.2 Process control

I should like to refer in this context to the paper I read at the UNIDO meeting (12). One of the many important checks concerns the pH of the pickle and the chrome tanning liquor at the end of tannage. Stable pH conditions are compulsory if uniform products are to be obtained. Problems may arise in small factories which frequently do not have a sampling machine. There the chrome tanned leathers must be hung up,

if possible not in the blazing sun. The period required to obtain uniform drying to a degree ideal for shaving must be determined through practical trials for each individual case. If a shaving machine is not available, the best thing to do is to make up new batches according to 2 or 3 categories of skin area. Very small, thin skins and large, thick skins must never be processed in one batch. Otherwise uniform leather quality and, accordingly, good profitability are impossible to achieve. Furthermore, higher safety can be obtained by checking also the pH of the neutralization and retanning liquors, and by carefully preparing the emulsion of oils and fats for fatliquoring, for these operations have a decisive influence on the finishing of the leathers with pigment finishes.

Similar considerations must be made in the vegetable tannage. Particularly important for the tannage in pits is that the tanning liquors are strengthened or renewed in time. The addition of synthetic tanning materials improves leather quality and promotes the utilization of the natural tanning materials. To keep the oxidation of tanning materials at a low level, the batches must always be covered during storage in wet state, and drying must be carried out as slowly as possible and not in the blazing sun.

8.3 Analytical inspection

This mainly includes the examination of the leathers with regard to the content of chrome oxide, water, and grease, and the determination of the pH value and the difference number of the leathers. These examinations are indispensable in the export business if complaints by customers are to be excluded from the very beginning or reduced to a minimum. Moreover, it is important that the skins have roughly the same water content before they are wrapped into pvc material and pressed into bales. In the case of vegetable

tanned leathers, the most interesting values are: quantity of fixed dyestuff, tanning number, total water solubles, pH value, and difference number. Details, as far as exports are concerned, are given in the paper of J. H. Sharphouse (14).

9. Machines

The following machines are particularly important: splitting machine, shaving machine, fleshing machine, hydraulic press, spraying machine. Quality and quantity of production are highly dependent on the performance of these machines. In developing countries, robust machines that require little maintenance and are not prone to repair should be preferred. To lower investment costs, reconditioned machines may be installed. Another important factor is the necessity of having a sufficient stock of spare parts, especially for the machines mentioned. The same applies to meters, electrical switchboards, apparatus, and other equipment used in manufacture and for quality control. The importance of proper machine maintenance, in particular in wet processing, is self-evident.

10. Personnel

10.1 Trained personnel for management

In each department 2 persons must have supervisory functions. They must be able to deputize for each other or they must be available if 2 shifts are worked. Their activities are manifold: supervision and control of production, contact with commercial departments and with workshops, sorting of batches, training of unskilled workers.

10.2 Trained personnel for production

Their main functions are: operation of machines, assistance in the sorting of batches, providing chemicals, training of unskilled workers, and other activities.

10.3 Trained personnel in the laboratory

The employees in the laboratory do the work described in previous paragraphs. Examination of output may also be one of their functions.

10.4 Trained personnel for machinery

A factory stands or falls with the availability of a sufficient number of well-trained mechanics, fitters, and electricians. Quality and quantity of production will suffer if everyday repairs are not carried out expertly and rapidly; frequently emergency solutions will be required. In the training of skilled personnel in a leather factory, this section of the staff must have the same opportunities as other sections.

10.5 Trained personnel for administration

Their tasks are organization and administration, including purchasing, sales, drawing-up of the production programme in cooperation with technical management, calculation, social welfare, and similar activities.

11. Waste

In this context I would refer to the papers read at the UNIDO meeting in 1971(14)(B)(25). They contain numerous recommendations for the utilization of waste material for human nutrition, animal feedstuffs, processing into gelatine, glue and fertilizer, and for the manufacture of leather board.

12. Summary

The intention of this paper was to demonstrate the relationships between domestic raw material, leather production, and leather processing. There are principles in leather manufacture which are essential with regard to quality and quantity

of production. Medium-size and large companies with corresponding machinery and staff are better equipped for future progress. But small and even very small factories also have chances of developing, provided they adopt the recommendations given here wherever and whenever possible. Integration into production groups, without completely giving up independence, can accelerate this development. The shoe and leather goods industry of a developing country can only participate in and profit from the development of the economy as a whole if it is capable of producing leathers of good and uniform quality.

Tables

- 1.) 100 kg salted weight = 100 kg pelt weight, fleshed, unsplit
(100 kg dry weight = approx. 200-250 kg salted weight)
- 2.) 100 kg pelt weight, according to item 1) correspond to
= approx. 70 kg pelt weight of a
splitting substance of approx. 3 mm
- 3.) From approx. 100 kg pelt weight, according to item 2), one obtains
 - a.) approx. 40-45 kg shaved weight, shaving substance 0.7-1.3 mm
 - b.) approx. 50 kg shaved weight, shaving substance 1.4-2.2 mm
- 4.) Survey:
 - 100 kg salted weight = approx. 100 kg pelt weight, unsplit
 - " = approx. 70 kg pelt weight, split
 - " = approx. 30 kg shaved weight, 0.7-1.3 mm
 - " = approx. 35 kg shaved weight, 1.4-2.2 mm
- 5.) 100 kg salted weight correspond to approx. 250-350 sq.ft. finished leather.
- 6.) 100 kg salted weight correspond to approx. 150-200 sq.ft. finished leather.
- 7.) Quantity of splits obtained:
100 kg salted weight yield on average 10 kg chrome tanned, utilizable splits (only skins of 15 kg or above).
- 8.) Shavings: 100 kg material, chrome tanned, summed give:
approx. 90 kg grain leather, approx. 10 kg shavings.
- 9.) Chrome leather from small skins
Refer to items 5.1.4 and 5.1.5. However: 100 kg shaved weight correspond to 300-400 sq.ft. finished leather.

10.) Vegetable tanned leather (heavy hides)

Similar conditions as in item 5.6.1. However:

100 kg salted weight may correspond to 110-120 kg pelt weight, fleshed,

100 kg salted or pelt weight should give 60-70 kg finished leather.

11.) Water consumption

Total requirements for 1 kg salted raw material (= approx. 0.5 kg dry weight):

a) Chrome leather production 60-80 litres of water.

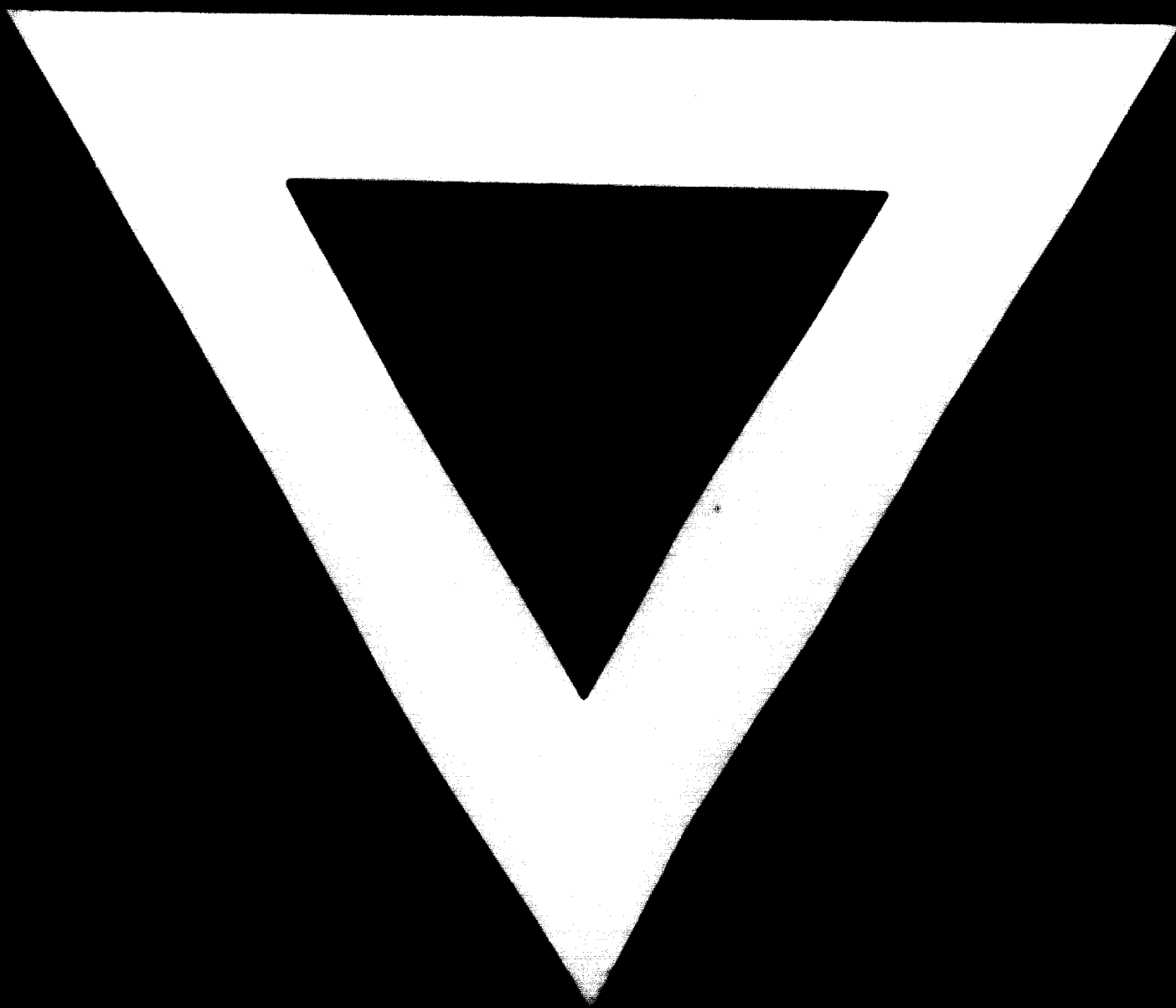
in detail:

soaking, incl. rinsing processes	approx. 25 % of total consumption
liming, incl. rinsing processes	approx. 20 % of total consumption
deliming/bating, incl. rinsing process	approx. 10 % of total consumption
pickle/chrome tannage	approx. 3 % of total consumption
neutralization, retanning, dyeing, and fatliquoring	approx. 20 % of total consumption
finishing	approx. 5 % of total consumption
miscellaneous consumption	approx. 17 % of total consumption

These figures can be reduced by 25-50 % if modern procedures are employed, which means that total consumption would amount to only 30-50 litres of water per kg salted weight.

b) Vegetable tannage 50-60 litres of water

Here too, modern processes permit substantial savings.



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