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09074

RESTRICTED

DP/ID/SER.A/205
12 July 1978
English

(2)

PILOT PROJECT IN PRODUCT ADAPTATION.

DP/ROK/72/023

REPUBLIC OF KOREA

Technical report: Chrome tanning and
finishing of leather

Prepared for the Government of the Republic of Korea
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

00000

Based on the work of Max May, leather chemist

United Nations Industrial Development Organization
Vienna

id. 78-4478

Explanatory notes

References to dollars (\$) are to United States dollars.

In tables a dash (-) indicates that the amount is nil or negligible.

The following abbreviations have been used in this report:

KGMIF	Korean General Merchandise Inspectors Foundation
KIST	Korea Institute of Science and Technology
KORSTIC	Korea Scientific and Technological Information Center
KOTRA	Korean Trade Promotion Corporation
KRICT	Korea Research Institute of Chemical Technology
MCI	Ministry of Commerce and Industry
TPP	Tanning Pilot Plant
VESLIC	Verein Schweizerischer Lederindustrie Chemiker

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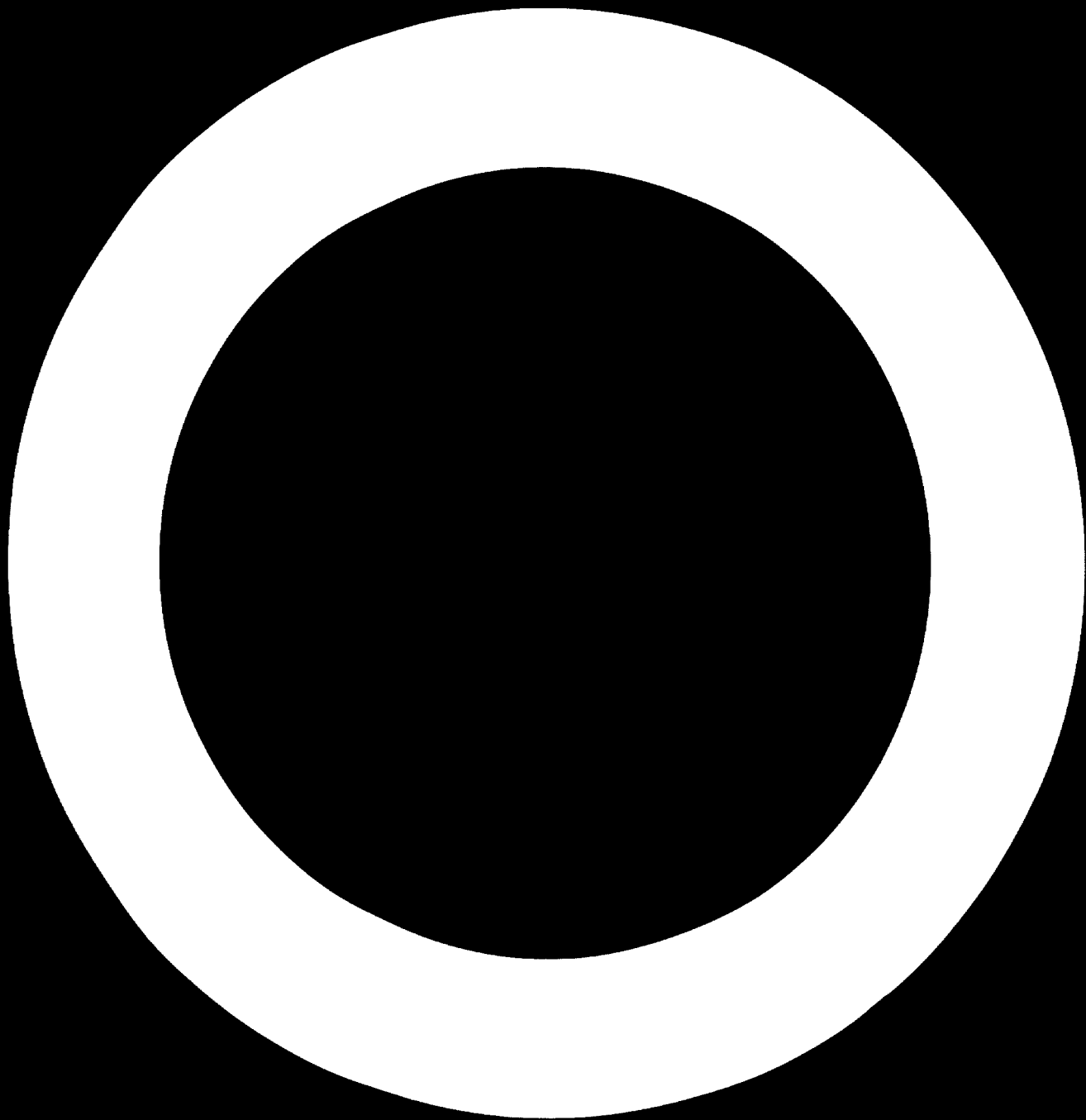
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ABSTRACT

In 1977, after 10 years expansion reaching a formidable leather goods export volume of \$428 million, leather manufacturers in the Republic of Korea suffered a severe shortage of highly-skilled, experienced technologists. Only about 100 were available instead of the 500 required.

Planning is required for hide and skin supplies, plant organization and modernization, systematic production and quality control, production flexibility, better shoe uppers, softer gloves, well-finished bag leathers etc. In order to develop the market, it is essential to make attractive leather of high quality, good looks and natural feel. To convey modern technological know-how to the leather industry, practical case studies were made with over 50 technicians in their tanneries; a two-day seminar was held by the Korean Trade Promotion Corporation (KOTRA) on leather; and a text book distributed. The outlook is bright for the leather manufacturers in the Republic of Korea provided adequate measures, as indicated, are taken.

The planning of the Tanning Pilot Plant (TPP) by an experienced team of Italian experts would cost approximately \$30,000, which is estimated to be about 10% of the total cost of plant and machinery for the TPP.



CONTENTS

<u>Chapter</u>	<u>Page</u>
INTRODUCTION.....	6
I. FINDINGS.....	7
II. RECOMMENDATIONS.....	15

Annexes

I. Leather goods export performance 1976 and 1977.....	19
II. Import of raw hides by country.....	20
III. A model for tannery staff.....	21

INTRODUCTION

The Government of the Republic of Korea requested assistance from the United Nations Development Programme (UNDP) for the project "Product Adaptation" (DP/ROK/72/023). This request was approved and the project commenced in 1975. The United Nations Industrial Development Organization (UNIDO) was the executing agency and the Korean Trade Promotion Corporation (KOTRA) was the counterpart.

An expert in chrome tanning and finishing of leather was sent to the Republic of Korea on a three-month split mission from 21 November to 17 December 1977 and from 27 February to 29 April 1978.

The expert's duties were to study the production processes currently in use in tanning and finishing of leather in the Republic of Korea, and to suggest ways and means of improving them. This job was to be carried out by giving in-plant assistance and holding seminars on the tanning and finishing of leather.

The objective of the project was to assist the leather industry of the Republic of Korea to improve the quality of processed leather, especially that intended for the export market. The leather industry suffers from a severe shortage of highly-skilled experienced technologists. Only 100 technologists are available in the country but 500 are needed. The industry also needs better plant organization and planning of production to turn out higher quality products.

The expert's recommendations are contained in the body of the report.

I. FINDINGS

The potential of leather goods manufacture

In 1977, the Republic of Korea exported leather goods of an approximate value of \$428 million (annex I). In the same year (up to October), it imported 3.6 million raw hides and skins, mainly from Australia, Canada, New Zealand and the United States of America, of an approximate value of \$107 million (annex II). It also used 0.4 million hides of domestic origin. In 1976, consumption of calf, sheep, goat and pig skins was approximately 0.2 million.

The quality and types of raw hides

The hides, mainly cow, steer and ox, have an excessive amount of grain damage which reduces the production of drum-dyed aniline leather to only 5%-15%. In addition, they are too heavy for high-class garments, gloves and the sides of soft boxes. For such items, hides of 12-18 kg, such as the European Hollstein, should be imported but out-dated hygiene regulations prevent this. Amendments of these regulations are being considered. About 30% of the total imports of 3.6 million hides, should be of the 12-18 kg class. Since such hides of fine grain are not available in the Republic of Korea, finished aniline leather has to be imported from Japan for medium and high quality garments, gloves and soft-box sides.

The production of garment nappa from New Zealand sheep and Bangladesh hair sheep or goats for suede is too small and should be developed. The raw hide import regulations for the latter need examination. Joint ventures to produce wet blues for the Republic of Korea, e.g. in Bangladesh, according to specifications would be a possibility. Other joint ventures or contracts to secure high quality hide supplies, such as wet blues, from Europe, Federal Republic of Germany or South American countries are of the highest importance for future export development.

The tanneries

Master plans for high productivity and flexibility

Starting a leather industry almost from the beginning creates problems but offers also a great chance to create a progressive modern leather industry which is part of the chemical industry. At the start know-how should be bought to prevent loss of investments. Presently, many tanneries are suffering losses because of labour costs, effluent problems and unpleasant working conditions resulting in reduced quality and productivity. A master plan, with a highly

experienced team of tanning specialists, could have saved many millions of dollars and would have resulted in greater flexibility, and safe, clean and high productivity. Future investments are still needed and should be made on the basis of such a master plan. An industry earning \$400 millions can only grow if kept in good health on the basis of 3-, 5- and 10-year investment plans. The relatively low wages, which are now 5%-8% of production costs, are expected to double in 5-6 years. The best of the working force will soon be lost to other cleaner industries and well-planned investment is required to compete profitably.

Machinery and maintenance

The production flow could be greatly improved, and capital saved by a careful study of machine capacities, choice of machines and regular maintenance of all mechanical equipment. A tannery machine life span can be 10-15 years. The longer life justifies additional capital investment for the best machines, which are not necessarily the most expensive, e.g. Mosconi or Turner precision splitting machines. Sammying and setting out machines are not used resulting in a yield loss of 4%-5% and making the finishing of high-class aniline leather for shoe uppers, bags etc. almost impossible. Other drawbacks are the use of plating machines of low efficiency and lack of smooth and embossing plates of top quality, particularly needed for low-grade raw hides.

At present, in many cases there is no possibility for the technician to achieve a high-quality leather simply because of the lack of proper equipment. The stress, therefore, should be on the consolidation of quality production before an increase of quantity to reach high value added.

Market adaptation at standardized quality

Profitability is endangered by three main factors: high raw hide prices, low yield, and low selling prices. Selling prices should ensure a net profit of at least 4%-8% and depend on the buyer's confidence in the standards of selection. Buyers' claim that their standards are in many cases not met.

The control of quality standards for export is of great importance and needs the backing of a neutral institution such as the General Merchandise Inspection Foundation (GMIF), to set and guarantee standards. At present, the buyers come to buy "cheap". Such an attitude precludes recognition of individual quality efforts, consequently production costs are often not covered. This circle must be broken by bold efforts to build up a healthy quality image. Present prices of 80-90 cents per square foot of garment leather are alarming in the face of rising raw hide prices.

Chemical sample import regulations prevent fast market adaption

Before production packs of 2-5 tons can be made, the tanning process formulations, up to finishing, must be worked out by as many as 5-10 pilot-plant packs of 200-500 kg. For such development work, samples must be obtained fast and easily in quantities of 10-50 kg. Presently, there are insufficient sample stocks of chemical agents, which leads to a delay of 3-4 months. Adding 2-3 months for the experimental working time in the pilot plant, it takes up to six months before the first production trial pack can be executed. The execution of the trial pack takes another 1-2 months. The eight months needed for a new article from demand to first delivery is about four times longer than in Italy. There are two fashion collections per year in the leather industry: spring/summer and autumn/winter. An exporting leather industry in the Republic of Korea should attempt to shorten production preparation to three months in order to follow fashion. The tanneries should be allowed to obtain quickly the best samples from foreign or home markets. This policy would pay since leathers fetch higher prices according to fashion trends. The quality of chemicals are decisive for the quality of leathers.

Flexibility to switch production to market demands

A country having only 10% of the raw hides it uses is bound to gain value added by doing fine work, with the highest possible flexibility of choice. The conception of flexibility as proved by France, Hungary, Italy, Spain etc. and lately also by Argentina and Brazil in the field of leather, is also feasible in the Republic of Korea where the will to work hard is outstanding. A highly skilled planning group and a modern staff-training facility will enable the leather industry to meet market demands.

A present, chemical industry technicians from France, Federal Republic of Germany, Italy, Japan, Switzerland, the United Kingdom of Great Britain and Northern Ireland and the United States contribute a lot of technical know-how, which increases export market adaptation. However more is needed for the country to become highly competitive.

Training of tannery staffs

The gap in know-how between large, medium-sized and smaller firms is at present far too wide. Some larger firms (processing above 500 hides daily) have established experimental laboratories, including physical and chemical testing. With such a base, some training is possible provided experienced team leaders have the time to train their men. However, much more needs to be done.

The experience of the expert in over 60 leather-producing countries has shown that in the long run, medium-sized firms processing 500-1,000 hides per day can, if they are well controlled, maintain high quality standards better than small or large firms. This may be because the individual attention and co-ordination needed by the staff in a modern plant are easier to achieve at such a level of production.

It is in the interests of the entire leather industry to give the staff of large, medium-sized and small firms the same basic production training after a good education, such as chemical engineering at a university.

For estimates of the staff needed to produce 250 million square feet of high quality, fashionable leather (based on the number of staff in firms in Italy) see annex III.

A modern institute to train tannery staff

To fully exploit plant investments, high levels of skills in technology and economics are necessary when facing fierce competition in the export market. Leather-exporting nations, such as Brazil, India, Pakistan, Tunisia, Turkey, all have well-equipped training facilities for leather technology. The Republic of Korea, with a leather export volume of \$428 million in 1977 (4% of the 1977 national export volume), has none. To expand and survive in the export market, modern staff training and applied research facilities are essential. A 10-year lag has to be overcome.

The Tanning Pilot Plant (TPP). This would be a small, but up-to-date model tannery which would process about 250 kg of hides three times per week. Its production programme should be concentrated on such types of leather as are needed for both export and local use. A case study of production processes should be made. It should include the processing of raw hides or raw skins through all 50 or 60 production stages to the finished leather, ready for sale. It should deal with the types of raw hides and the selection of the most economical. The study should estimate the cost and undertake essential production and financial planning for chemicals, equipment, labour, energy, effluent and other items.

Special attention should be given to various phases of production under systematic, scientific control accompanied by chemical analysis. The results should be systematically recorded. Based on such precise controls, the theoretical aspects of each of the 50 or 60 production phases should be recorded and further

studies made if needed of chemical and physical phenomena, their interdependence and influence on the final properties of the finished leather. By such a controlled production profound knowledge would be gained. Such a case by case approach would build up top quality know-how in a short time.

The economic section of the TPP will deal with hide and skin, machines, and chemical production cost, and sale prices. In addition it would have:

The lime yard

The tannery section

The dyehouse - retanning, sammying and setting section

Drying, conditioning, staking, milling, toggling etc.

The modern finishing section

Hides, skins and chemical stores

Model of production control laboratory for chemical, physical and optical leather testing

An additional laboratory for specific production problems of the leather industry

A trouble-shooting unit of two technicians, equipped with a mobile laboratory in a large van, should be part of the TPP to give practical demonstrations, particularly to those firms that cannot afford their own laboratories

A separate integrated laboratory for the control of finished leather and leather goods should be established. Reasonable, technologically possible, quality standards should be established based on case studies and customer demands. Quality standards should be compared with other institutions, such as Gerberschule 1/ Reutlingen, the College of Technology, 2/ Satra, 3/ Dutch 4/ and Swiss 5/ Government testing institutes, before their application to the leather goods industry of the Republic of Korea. All quality standards before being applied should be agreed upon by:

The Korean Leather Chemists' Association

The Korea Tanners Association

The Leather and Fur Exporters Association

Only by co-operation with these bodies and with the General Merchandise Inspection foundation can quality improvements be made.

The design sections of TPP would advise on styling and production technology for shoes, garments, leather bags and gloves of all kinds.

A design section could be established as a second step, although this is very important, particularly in the case of medium-sized and smaller firms.

1/ Reutlingen, Federal Republic of Germany.

2/ Northampton, United Kingdom.

3/ Shoe and Allied Trade Association, Kettering, United Kingdom.

4/ T.N.O., Woolwich, United Kingdom.

5/ Eidgenössische Materialprüfungs-Anstalt, St. Gallen, Switzerland.

A blueprint for the TPP

The cost of the planning of TPP by an experienced team of Italian experts would cost approximately \$30,000 which is estimated to be about 10% of the total cost of plant and machinery for the TPP.

Financing of construction and maintenance of TPP. A fee on exported leather goods of approximately 0.6% during the first two years of construction and operation and of approximately 0.3% for maintenance are estimated to be needed, but financial estimates should be based on a study.

The staff of TPP. Eleven of the best qualified chemical engineers with a minimum of two years tannery practice in the Republic of Korea and a good knowledge of English or German should be selected, to be trained for two years at a reputable leather chemistry college, such as Gerberschule Reutlingen or the Northampton College of Technology. Six students would become teachers, two would form a mobile team of trouble shooters, and three would do leather research. An additional chemical engineer should be trained for four years at the Technische Hochschule Darmstadt, Federal Republic of Germany under Prof. Heidemann. He should have at least two years practical experience in a tannery, and training in economics and organization. He should be appointed research head of the TPP. In exchange for the training imparted, all 12 fellows should agree to serve the TPP at least six years, at an agreed salary.

TPP would also need two college graduates to be trained for six months at Gerberschule Reutlingen, and three months on machine maintenance. Their duty would be to manage the TPP production. One man would cover raw hide to wet blue and the other retannage dyeing fat-liquoring and finishing. Four to six workers would handle production. For the laboratory, four to six well-educated women chemists could take care of physical testing and analytical work. In addition, personnel would be needed for administration and cleaning duties.

The board of the TPP. Experienced members of the following institutions should form a technical and economic board for TPP.

<u>Number of persons</u>	<u>Institution</u>
3	Leather Chemists' Association
3	Tanners Association
1	Korea Research Institute of Chemical Technology (KRICT)
1	Leather and Fur Exporters Association
1	Promotion and Marketing of KOTRA
1	KGMIF

The board should formulate the priorities of functions of TPP in co-operation with the staff of teachers.

The board would also decide on foreign advisors needed to start TPP, particularly in the first 2-3 years.

The TPP as a possible satellite of the Korea Research Institute of Chemical Technology (KRICT). KRICT, because of its scope of activity, would be a good institution under which TPP could be administered. Since modern leather manufacture is a chemical technology, a link-up could be advantageous and save extra administration costs. TPP should be located near the leather industry of Seoul and its commercial centres.

The two-day seminar of UNIDO and KOTRA on leather retanning, dyeing, fatliquoring and finishing

This was the first seminar UNIDO and KOTRA organized for the Korean leather industry. It was attended by 70 leather technologists from 30 tanneries.

A summary of the official leather test methods of IUF^{6/} and on VESLIC (Vereins Schweizerischer Lederindustrie Chemiker) of the Swiss Leather Chemists' Association was given for the benefit of future leather chemists' association. The testing methods will be of great value in establishing production and quality control in tanneries.

Practical and theoretical training by case studies was given by the UNIDO expert. About 50 leather technologists, managers of tanneries and section heads participated. The case studies were from four tanneries, producing 4,900 hides daily (representing approximately 32% of the leather industry), and were on the fabrication of garments and shoe uppers, from raw hide to chrome tanning, using different retanning and dyeing methods. They included variations of aniline, semi-aniline and covering finished with an aniline look on the shoe uppers and garment leather. Five trials and a production pack of 2.5 tons were done with very good results. All operations were on standard processing sheets.

The Korea Leather and Fur Exporters Association

A meeting was held with the executive director, and two board members. The importance of building up a quality image, particularly for garments, was discussed. It was explained that more advanced staff training in tanneries,

^{6/} Methods officially accepted by the International Union of Leather Technologists and Chemists Societies for colour fastness.

shoe, garment and bag factories was essential to achieving greater value added. Today boots cost \$8 and a finished jacket about \$36-\$39.

It was stressed that the rise in prices of hide was creating financial problems. It was suggested that hides be bought in the 14-18 kg range as these were better suited for garments. Raw hide should be tested. The garment buyers prefer finer grain (14-18 kg) sheep nappa pure aniline and top grade finishes with an aniline look.

Leather industry associations

A leather chemists' association should be formed as a professional body to develop leather-testing methods, to organize technical seminars, to select young engineers for advanced training abroad, to develop self help by exchanges and collection of technical views and information, and to offer advice when requested.

A tanners' association was also being discussed. It would speak for the leather industry in co-operation with the Ministry of Commerce and Industry (MCI).

Both associations should be linked to the International Leather Chemists' Association and the International Tanners' Council.

Scientific and technological institutions

The Republic of Korea has organized and already put into operation, some very highly developed scientific and technological institutions. Such institutions can also help, in many cases, the leather industry which deserves attention as an important contributor to the country's exports. Questions of effluent disposal, safety, optical investigations of leather produced etc., and specific production problems should be passed on. A literature service for technical information would be helpful. The institution of the Leather Chemists' Association should have information links with them.

The following institutions were visited and briefed:

- Korea Institute of Science and Technology (KIST)
- Korea Scientific and Technological Information Center (KORSTIC)
- Korea Research Institute of Chemical Technology (KRICT)

The Ministry of Commerce and Industry Division of organic chemistry was visited and a discussion held on the basis of a provisional summary of the recommendations made by the expert.

II. RECOMMENDATIONS

The leather industry in the Republic of Korea has grown at a most unusual rate during the last 10 years. It was lucky to hit the largest fashion wave of leather garments there has ever been. That wave of cheap garments is declining now. But there are export possibilities for aniline garments, sport garments, casual and fashionable shoes, leather luggage, bags, gloves for sport and work, and leather for room and furniture decoration. The outlook for the leather industry is very good, provided that tannery staff quickly acquire the know-how essential for meeting changing export trends, and can with great flexibility, produce leather of the highest possible quality, with the look and feel that the customers demand. To achieve these essential goals, the tanning industry installations must be modernized to increase productivity and consistently produce goods of high quality, to build up confidence of buyers. The leather industry should be thoroughly planned to encourage further growth. The following recommendations are made to assist with such planning:

1. A pre-project and a definite project plan (blueprint, with cost estimations and calculations) for a modern Tannery Pilot Plant (TPP) have to be established by an experienced team. It should be an up-to-date training facility in applied leather technology, production research, production planning, economics and production control.
2. A model project of a leather production unit for 500 and 1,000 hides per day should be made by experts; the layout and the cost estimates should be used as guidelines for financing institutions, leather manufacturers, marketing and promotion. The model project should serve as basis for the planning of joint ventures and the export of plants to other developing countries.
3. Eleven chemical engineers should be carefully selected for specialized leather chemists' training. They must have at least two years leather manufacturing experience in the Republic of Korea or abroad, a good knowledge of English or German and ability for organization and teaching. These engineers should be trained for two years at the Gerberschule Reutlingen, the Federal Republic of Germany (six students) and the Northampton College of Technology, England (five students). If possible they should also work for three months (during college breaks) in a tannery in the Federal Republic of Germany, Italy or the United Kingdom. These eleven students plus one administrator and research leader would be the nucleus of modern leather manufacture in the Republic of Korea. In return

for their education, they must commit themselves to serve the Tannery Pilot Plant, at agreed salaries, comparable to those in the leather industry, for at least six years, as follows:

(a) As teachers. Six persons should supervise production control and one should specialize in economics;

(b) As applied leather research staff. Three persons should also do control and two persons should act as a mobile, trouble shooting team, helping small and medium-sized leather factories by practical demonstrations and theoretical explanations, to adopt new, modern methods of manufacture. A large van, equipped as a mobile leather laboratory, would be needed;

(c) One person should act as administrator, teacher and co-ordinator to plan and lead the applied research activities of TPP. Preferably his training should be for four years at the leather section of Technische Hochschule Darmstadt, Federal Republic of Germany

In addition to running the TPP, practical instruction of students should be carried out for which the teaching staff should have the know-how to maintain and use machines and to organize production flow etc. Their training should consist of at least:

A 6-month foreman course at Gerberschule Reutlingen

A 3-month tannery machine maintenance course at tannery machine factories, such as Turner, England; Rizzi, Italy; Trocken-Technick, Federal Republic of Germany etc.

4. From four to six experienced workmen should be selected to work in the tannery. They should speak some English. For the laboratory, six female personnel, with a good education in analytical chemistry, should be engaged to work in production control (2), applied leather research (2), and finished physical leather testing (2).

In addition, personnel would be needed for the administrator's office and for cleaning duties.

5. Leather industry associations should be co-ordinated to serve the leather industry as such, TPP, and the Ministry of Commerce and Industry. Their functions are as outlined below.

The functions of the Leather Chemists' Association should be applied research at TPP; product development (leather); technical information at TPP; technical seminars at TPP; introduce and adapt production control methods; develop quality standards in co-ordination with the KGMIIF.

A tanners' association should be formed whose functions should be to make studies of hide supplies, leather factory installations, the standardization of leather production and the sale of leather.

Leather and Fur Exporters' Association

6. The economical and technical functions of the leather and fur association, up to now, have been the manufacture, for export, of leather, shoes, garments, gloves etc. the marketing of finished goods; and their promotion.

TPP should have a ten-member board composed as follows:

One member of KGMIFF

One member of KRICT

One member of KOTRA

One member of the Leather and Fur Exporters' Association

Three members of the Tanners' Association

Three members of the Leather Chemists' Association

A board of ten advisors at the disposition of MCI:

One member of KRICT

One member of KOTRA

One member of KGMIFF

One member of the Leather Chemists' Association

Three members of the Leather and Fur Exporters' Association

Three members of the Tanners' Association

The two boards would have to work out and follow up a plan for the leather industry. Based on such a structure, a long range conception for the leather industry, leading to rationalized, high quality leather production, could be successfully set in operation. Free competition of the tanneries should not and would not be reduced, but the industry should be made to operate at a higher, more sophisticated, level in order to become strong and competitive.

7. Among the 30 to 40 larger tanneries, 30 talented chemical engineers, with at least 2-5 years experience, should be selected for two years of technical training at the following institutions:

Northampton College of Technology, England (10)

Ecole de Tannery, Lyon, France (5)

Gerberschule Reutlingen, Federal Republic of Germany (10)

Leather Institute TNN0, Waalwijk, the Netherlands (5)

For any engineers who could not be spared for such a long time, the next best training would be a six-month course at the Gerberschule Reutlingen.

It is feasible that an established TPP could train 250 chemical engineers for six months each and 250 section heads for three months each.

8. Special case studies of applied research could be carried out at TPP, directly helping the leather industry. Priority subjects should be aniline dyeing and finishing.

9. The trouble-shooting unit, with a laboratory van, should concentrate on the 10-20 medium-sized and 30-40 small tanneries.

10. TPP should run a long-range training programme for the following:

(a) A two-year course for chemical engineers with 10-20 students every two years to train as technical managers;

(b) A one-year course for chemical engineers with 24 students per year to train as section heads;

For the foreman

(c) A three-months course with 50 participants per year of high school level to train as foremen. After five years in the leather industry, each student should have a three-month refresher course.

Introduction of the official IUF leather-testing methods

11. To accord with international quality standards, the leather industry associations of the Republic of Korea should become members of international counterpart organizations.

12. To improve shoe manufacturing plants for well diversified experts, a very experienced shoe expert, with good connections in Europe, Japan, the Middle East and the United States, should work out a modern marketing and production plan which should co-ordinate the production of upper leather and shoes.

13. A healthy leather production for export should be diversified as follows:

55%-60% shoes (for sport, casual, military and fashionable use)

25%-30% garments, sports gloves, motor-bike suits, furniture

20%-10% bags, sport articles and other labour-intensive leather articles. (Fur garments are not included but should be promoted.)

Annex I

LEATHER GOODS EXPORT PERFORMANCE 1976 AND 1977

Item	1976		1977	
	Thousands of dollars	Percentage of total exports	Thousands of dollars	Percentage of total exports
Leather garments	177,187	55.3	205,950	48.1
Fur garments	26,870	8.4	34,802	8.2
Leather shoes	47,389	14.8	59,558	13.9
Bags	11,446	3.6	28,778	6.7
Balls	4,197	1.3	7,010	1.6
Baseball gloves	22,878	7.1	28,759	6.7
Work gloves	6,555	2.0	8,974	2.1
Golf gloves	2,208	0.7	8,189	1.9
Other gloves	9,177	2.9	27,471	6.5
Uppers	7,804	2.4	9,447	2.2
Others	<u>4,660</u>	<u>1.5</u>	<u>9,126</u>	<u>2.1</u>
Total	320,371	100	428,064	100

Source: Leather and Fur Association.

Annex II

IMPORT OF RAW HIDES BY COUNTRY (UP TO OCTOBER 1977)

Item	Currency	Australia	Canada	Japan	New Zealand	United States	Other	Total
Kid skin	SH ^{a/}					10,192	-	10,192
	kg					139,528	-	139,528
	⌘					198,604	-	198,604
Cow hides	SH	44,183	177,401	13,538	64,897	2,849,263	2,385	3,151,667
	kg	921,138	4,211,167	283,962	1,211,245	40,825,856	60,499	47,513,867
	⌘	929,009	4,921,967	285,664	1,478,585	47,302,320	63,768	54,986,313
Steer hides	SH		217,442	6,779		1,355,147	-	1,579,368
	kg		6,282,812	197,566		35,955,830	-	42,436,208
	⌘		5,971,212	204,803		38,699,433	-	44,875,448
Ox hides	SH	29,797			22,019	1,500	600	53,916
	kg	696,446			490,934	33,000	16,062	1,236,442
	⌘	689,613			587,204	36,932	14,062	1,327,811
Bull hides	SH	450				14,616	-	15,066
	kg	15,919				540,679	-	556,598
	⌘	12,351				470,742	-	483,093
Other raw hides	SH	187,487	17,646			33,081	-	238,214
	kg	4,344,582	477,823			649,661	-	5,472,066
	⌘	4,173,816	415,571			665,360	-	5,254,747

Note: Excluding calf.

a/ SH = Salted Hides.

Annex III

A MODEL FOR TANNERY STAFF

This model is based on a European leather factory producing monthly 1 million ft² high class fashion leathers, working 40 hours per week with a second shift of 44 hours for one third of the staff. The staff is as follows:

<u>Technical direction</u>	1	Technical Director	University plus
	2	Assistant Technical Directors	tanning college training
	5	Section heads, experienced	Tanning college training
	5	Assistant section heads, inexperienced	Tanning college training
<u>Tannery</u>	2	Limeyard, including rawhide stock and tanning until selection of wet blue	
<u>Retanning-dyeing</u>	2	Retanning, dyeing, fat-liquoring until crust	
<u>Finishing</u>	3	Finishing until selection and packing	
<u>Chemical control and development</u>	2	Laboratory and experimental tannery effluent discharge	
<u>Production control</u>	1	Quality and rentability controller: In charge of quality control, selection, production calculation, chemical and raw hide supply, flow of work, salary etc.	
	14	Foremen, tanning college course, six months	
<u>Maintenance</u>	1	Mechanical Engineer, university level	
	2	Foremen, mechanics	
<u>Maintenance</u>	7	Workers as machanics, carpenters etc.	
<u>Production</u>	167	Workers (50% women, 50% men)	
Tannery staff	27		
Maintenance staff	<u>3</u>		
	30		
Workers	<u>170</u>		
Total production department staff	200		

One million square feet of fashion leather produced by the tannery work force of 200 leads to a production of:

- 5,000 ft² per man per month (25 days)
- 200 ft² per man per day (8 hours)
- 25 ft² per man per hour

An example similar to the leather industry in the Republic of Korea would be: a garment and upholstery leather factory of similar structure and 1 million ft²/month reaching 34 ft²/man-hour.

Pre-conditions to reach 25-34 ft² per man-hour are a highly rationalized production flow, modern machinery and a staff with high professional standards to ensure constant high quality.

The quality level should be:

<u>(%)</u>	<u>(Grade)</u>
30-40	IA
45-25	II
28-28	III
5-5	IV
<u>2-2</u>	Rejects
100	

The average price of the IA-IV grades and rejects has to be calculated for each pack processed, according to standard type formulations. Fixed costs must be added and the breakeven point calculated. The production cost should allow for a net profit of 8%.

Staff training for the leather industry

The examples refer to fine leather, garment and upholstery tanneries producing top fashionable skins.

It can be assumed that a staff of 30 men would produce 1.4 million kg per month.

The 250 million ft² leather including split, in high, standard and export quality would require a qualified staff of $30 \times \frac{250}{1.4} = 5,357$ cadre men in the leather industry.

This estimate should be split up as follows:

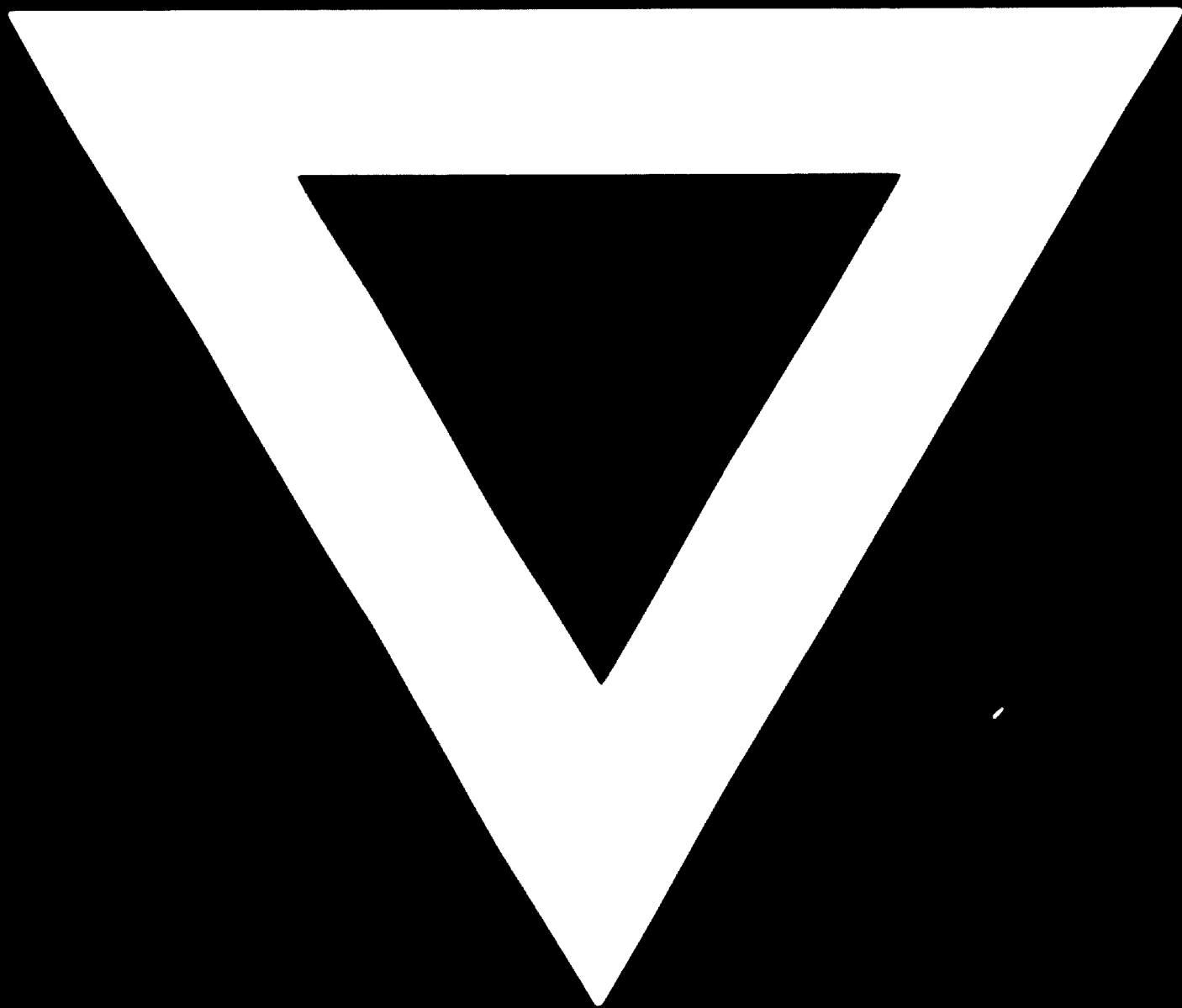
<u>Persons</u>	<u>Training</u>
$3 \times \frac{250}{1.4} = 536$	Chemical engineering degree plus tannery college 2 years, or specialized leather technology training at Technische Hochschule, Darmstadt 4 years
$10 \times \frac{250}{1.4} = 1,786$	Tannery technicians, Lyceum or high school plus 2-3 years Tannery college
$1 \times \frac{250}{1.4} = 178$	Mechanical engineers of university standard with practical experience
$14 \times \frac{250}{1.4} = 2,500$	Tannery foremen trained by apprenticeship as tanners plus 3 months basic training at professional school
$2 \times \frac{250}{1.4} = 357$	Professional trained mechanics, with an apprenticeship of 3 years
$30 \times \frac{250}{1.4} = 5,357$ Cadre total	

This could be considered as the ideal situation.

Tanners estimated that there were 20-40 well trained, experienced top technicians. The expert assumed the number to be higher, maybe 100. Most of them were chemical engineers, self-taught, who lack specific training in applied leather chemistry. Such was also the case for over 200 section heads of good education. A grave lack of mechanical engineers was also observed, creating losses in machine equipment and a lack of maintenance.

It is therefore most urgent to close the gap by special training in applied leather technology.

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