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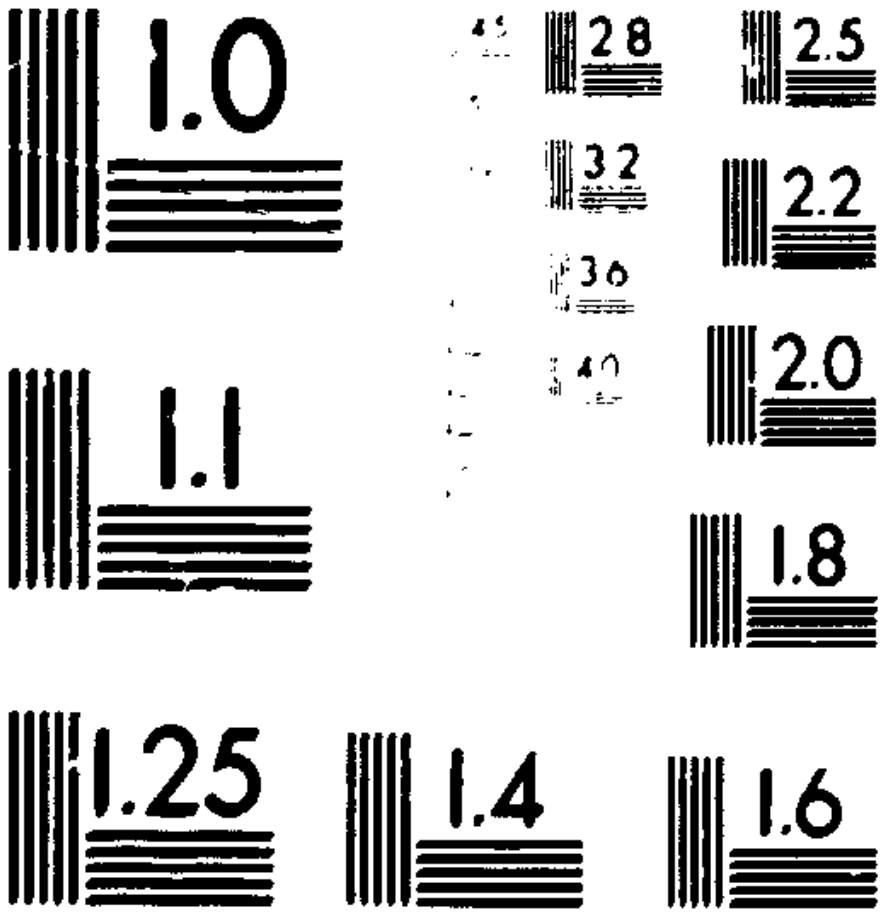

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UNIDO project No UD/PDY/79/140

Yemen PDR.

Techno-economic Study on the Viability of processing Sheepskins

in the

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

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EXPLANATORY NOTES

The monetary unit in the People's Democratic Republic of Yemen is the dinar (YD) and there are one thousand fills to one dinar. During the period covered by this report, the value of the dinar in relation to the dollar was YD 0,341 = $ 1.00

LIST OF APPLIED CHEMICALS

in description of technology

1. Peramit RC - wetting agent - Henkel - W.Germany
2. Solana ON - degreasing agent - Henkel - "
3. Delustin 2500 - bating agent - TEOL - Yugoslavia
4. Blankit IN - bleaching agent - BASF - W.Germany
5. Chromitan B - chrome salt - BASF - "
6. Lutensol ON 30 - levelling agent - BASF - "
7. Basyntan FCBI - syntan BASF - "
8. Leophen M levelling agent - BASF - "
9. Eskatan GLH - fatliquor - Böhme KG "
10. Eskatan GLS - fatliquor - Böhme KG "
11. Glanzlüster S - lustring agent - Böhme KG "
12. Antistatikum LG - antistatic agent - Böhme KG "
13. Lutensol AP-6 - levelling agent BASF "
14. Activol OLN - wetting and bactericidal agent Zschimmer und Schwarz "
15. Supralan UF - wetting agent Zschimmer - Sch. - W.Germany
16. Pelgrassol CSV - fatliquor Zschimmer - Sch. - "
17. Novoltan P - aldehyde syntan Zschimmer - Sch.- "
18. Blankit IAN - bleaching agent BASF "

TABLE OF CONTENTS

1. Abstract

UNIDO project No UD/PDY/79/140 under the name "Techno-economic study on the Viability of processing Sheepskins in the PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN" has been started with the visit of team teader Tomislav Vuković and mashinery technician Branko Polanec to project area in octobar 1984.

In the National Tanning factory at Sheikh Othman, Aden all for study necessary data were collected.

This study has been prepared by the team of experts according to the contract No 84/62, where in the annex E-Terms of Reference paragraph 3., the Scope of contracting services was givenn.

Together with the work on Study, exploring of sheepskins processing in saline water was done, and the results were given following the usual manufacturing process in this Study.

Conclusions of the Study indicate the necessity of processing fresh sheepskins into fure suitable for export to Europe and it is suggested a co-operation with an european enterprise.

2. Introdustion

The National Factory at Sheikh Othman, Aden was established as a private factory in 1960., but for economical reasons was closed down in 1978.
After that goverment of PDR Yemen has implemented a plan to rehabilitate the tannery. The repairing of the existing machines was made by local team, and with the assistance of Unido new machines and equipments from "Kostroj" Yugoslavia were purchased. At the same time a new building for leather finishing was constructed.

Unido expert Mr. Gerhard Felsner has controlled installation of new machines during the period of 4 months (Unido-project RP PDY/83/001) and reffered about the problem of wool sheepskins deriving from imports of australian live sheep. More then 100.000 wool sheepskins yearly have been stored in drysalted condition. The tannery has no dressing faciiities and a big part of stock was of poor quality. It was suggested by the expert, to process these skins to fur linings for shoes and garments, or for manufacture of car seat covers.

This Study deals with the technology of sheepskins processing to furs. According to the processes a list of machines and equipments was prepared, together with the data for space, required for the factory.

Technological process and necessary machines give also the data for consumption of chemicals, water and energy.
Capacity of soaking 400 pcs. sheepskins daily (10.000 monthly) determine necessary manpower for the production and their qualification. A plan of trai ing has been prepared.

Price of investment, costs of production and total sales give the necessary data to make decision about investment.

Processing of sheepskins to furs need a big quantity of water. Explored technology of processing in saline water will be an economic advantage.

Because of curing difficulties it will be necessary to process fresh sheepskins, what will give better quality and yield of final product.

3. Background of the Study

The background of the Study is contract No 84/62 between Unido and Tehnološki centar, where the annex E in terms of references specify the services of contractors.

3.1. The Scope of Contracting Services

The contractor shall prepare a techno-economic study which shall specifically include the following services:

a) to prepare a list of machinery and equipment which would enable the National Tanning Factory to process 10.000 - 12.000 wool sheepskins per month;

b) to prepare a layout of the necessary processing facilities and equipment with regard to the existing infrastructure and tanning plant in order to secure an easy flow of the envisaged production;

c) to specify the additional floor space required and outline the civil work to be done ;

d) to work out suitable processing methode for optimum productmix and to estimate the expected consumption of chemicals as well as the requirements for water, hot water and power (the possibility of using saline water for certain purposes should be explored);

e) to specify the requirements for manpower, training and transfer of technology ;

f) to explore the marketing prospects of the best product-mix, indicating potential buyers of partners for long-term collaboration;

g) to work out and present basic financial data relevant to setting up the wool sheepskins processing plant, such as: cost of equipment/construction, the overall value of the investment requirements, breakdown of the cost of production and manpower training, working capital required, sales expected, net foreign exchange earnings, etc.;

h) based on the findings, facts and estimates along the aforementioned lines, to advise the Government on the viability of establishing a unit for the processing of wool sheepskins in the National Tanning Factory;

i) in case that such an undertaking is found viable, to outline and recommend measures to be taken for its implementation.

3.2. *Srvices in the project area*

During two weeks in october 1984, team leader Tomislav Vuković and machinery technician Branko Poirnec have collected in project area necessary data about raw skins and the existing infrastructure in the National Tanning Factory "Sheikh Othman" in Aden - PDR Yemen.

a) Raw wool sheepskins

Slaughter house (Meat Corporation)

Price per piece :		250-300 fills
Weight per piece :	dryed	5 kg
	fresh	8 kg
Way of preserving :	drysalted	
Average area of skins in saft :		7
Length of wool :	60%	1/2 - 1"
	40%	1 - 1 1/2"

b) Water

Temperature of water from town supply system	32-35°C
Price of water	100 gallons - 65 fills

c) Electricity

Power of electric current transformer	1110 KVA
Price per KWh	35 fills

d) Average salaries of manpower man/month 71 YD

e) Prices of chemicals

chrome salt (chromitan 26% Cr_2O_3)	353 fills/kg
wetting agents	540 fills/kg
fatliquors	522 fills/kg

f) Machines

Some machines in tannery are suitable also for fur processing as:

- small fleshing machine
- buffing machine working width 250 mm
- staking wheel (Dravinja) 2 pieces
- toggle Dryer (Ekonom H 33)

4. Technological process

4.1. Car seat covers

Raw material : fresh wool sheepskins from Aden abattoir, green weight 8 kg per piece

I. Soak-in paddles

Add 1 g/l Peramit RC
run 2 hours, De-burring (Sabreuse)

I. Wash-in paddles, add

1 g/l Ammonium carbonate
2 g/l Peramit RC
2 g/l Solana ON
run 2 hours
Wash well, flesh by machine and trimm.

II. Soak-in paddles

Water at 25-30°C overnight, add

0,5 g/l Peramit RC
1,0 g/l Delastin 2500 (bating agent)
flesh by machine

II. Wash-in paddles

Water at 38-40°C, add

2 g/l Solana ON
2 g/l Delastin 2.500
1 g/l Peramit RC
1 g/l Blankit IN
run 90 minutes. Unload.
Raw shearing

Pickle-in paddles

Water at 28-30°C
60 g/l salt
6,0-7,5 g/l formic acid
run 8 hours or better leave overnight.

At the start the pH should be 2,0 at the and 2,0.

Recycling

for every new lot of skins add 30% salt and 50% acid

Chrome tannage - in paddles

Water at 25-30°C add
35 g/l salt
6 g/l Chromitan B
run 30 minutes
6 g/l Chromitan B
run 12 hours

To complete tannage 2-3 % calcined soda should be added carefully over 3 hours. Check pH. At the completion of tanning the pH should be 4,0.

Recycling

For every new lot of skins add 30% salt and 50% Chromitan B.

Now the skins for seat covers should be sorted out and the skins of inferior quality finished as fur linings.
Now the following machanical operations are carried out: sammying, drying, staking, trimming, strecning on frames and drying, sorting(i), shearing, combing, grinding, ironing, shearing(II), sorting (II) for seat covers and linings.

Dyeing and fatliquoring of tanned sheepskins for seat covers

Wet back - *Water at 40°C add*
- in paddle

1 g/l *Lutensol ON 30*
1 g/l *Ammonium carbonate*
run 1 hour, wash well

Dye in paddle - *Water at 70°C add*
(Colour: Anthracite)

0,5 g/l *Basyntan PCBI - 1*
0,5 g/l *Formic acid*
0,5 g/l *Leophen M*
run 5-10 minutes
0,25 g *Eukesolar schwarz RL*
0,03 g/l " *braun R*
0,01 g/l " *gelb GL*
run 30 minutes add
0,5 ml/l *formic acid*
run 30 minutes
Rinse with running water until clear

Wash - *Water at 40°C add*

0,5 g/l *Peramit RC*

Fatliquor - *in paddles*

Water at 45°C

1,5 g/l *Eskatan GLH*
0,5 g/l *Eskatan GLS*
run 40 minutes

Rinse shortly, drain, samm and dry (stretch on frames). Continue with mechanical operations: saw-dust drumming, staking, shearing and ironing. Before ironing put with a pad on the flesh side a mixture for better gloss:

200	ml	Peramit RC
25	ml	Glanzlüster S
25	ml	Antistatikum LG
50	ml	Alcohol
750	ml	Water
1000	ml	

1 - 2xiron at 185°C

Alternative colour for seat covers: CAMEL

Recommended process:

Wet back - Water at 40°C, add

1	g/l	Ammonium carbonate
1	g/l	Lutensol AP-6
		run 1 hour, wash well

Dye - Water at 70°C, add

0,5	g/l	Lutensol AP-6
1,0	g/l	Ammonia solution
0,04	g/l	Enkesolar Braun R
0,04	g/l	" Gelb GL
0,05	g/l	" Orange Rl
0,02	g/l	" Shwarz RL
		run 30 minutes, add
0,5	g/l	Formic acid
		run 15 minutes
0,5	g/l	Formic acid
		run 15 minutes

Fatliquor - *in the same float, add*

1,5 g/l Eskatan GLH
0,5 g/l Eskatan GLS
run 40 minutes, rinse shortly, unload.

4.2. *Fur lining*

Fur linings for garments and foot wear can be produced either in natural colour or coloured in brown shades. Not coloured lining is subject to mechanical operations only.

Recommended process for brown fur lining

Wet back - *Water at* $40^{o}C$

2 g/l Ammonium carbonate
1 g/l Peramit RC
run 1 hour, wash well until clear add
0,5ml/l Acetic acid
run 30 minutes, wash well, drain

Crome mordant - *Water at* $35^{o}C$

1 g/l Sodium bichromate
0,5 ml/l Acetic acid
run 1 hour, unload

Dye - *Water at* $40^{o}C$ *add*

0,8 g/l Ursoll NZ
0,1 g/l " P Base
0,1 g/l " 4 G
0,05 g/l " DM
run 30 minutes, add

0,75 ml/l Hydrogen peroxide
run 30 minutes, add
0,75 ml/l Hydrogen peroxide
run 2 hours, rinse until clear

Wash - Water at 45°C

1 g/l Peramit RC
run 40 minutes, rinse well

Fatliquor - Water at 45°C, add

12,5 g/l Salt
3,5 g/l Eskatan GLS
1,5 g/l Eskatan GLH
0,25 g/l Peramit RC

Run 45 minutes, unload and centrifuge. Continue with mechanical operations: drying, staking, shearing, measuring sorting.
Not coloured lining is only trimmed, measured and sorted.

4.3. Possibility of the use of sea-water for manufacture of furskins

Our exploring in this field has given good results, and we may suggest the use of saline water for all wet processes except dyeing.
The tested furskins were wet/salted australian sheepskins. The ratic of liquor to skins in paddle and drums was 1:10 (1 kg wet/salted sheepskin to 10 l water).

Note: in all manufacture processes up to colouring and fatliquoring, sea-water was used.

Soaking: was carried out under normal conditions, namely the temperature of water was 20°C, and 1 g/l wetting and bactericidal agent (Activol OLN) was added. All wetting agents in this research work should posses stability to electrolytes. After 30 minutes of running the skins remained in float overnight. In the morning a new float of sea water at 30°C was prepared, 1,5 g/l wetting agent added and run for 1 hour. After rinsing the skins were fleshed.

I. Fleshing: the machine used was made by KOSTROJ, working width 1250 mm. The skins were fleshed 2 times, from head to tail and from tail to head.

I. Wash: for this first wash sea-water was heated to 35°C and 1 g/l wetting agent !(SUPRALAN UF) was added as well as 1 g/l BLANKIT IAN (if bleaching offect is needed). After 2 hours of running the skins were well rinsed with warm water.

II. Fleshing : is carried out four times in all directions, and the float for the second wash was prepared.

II. Wash : sea-water at 30°C and 2-3 g/l wetting agent (SUPRALAN UF), after 1 hour running the float was drained and the skins centrifuged.

Pickling: water at 30°C, - after the skins and 50 g/l salt (NaCl) was added, the paddle was run for 20 minutes. Now the formic acid 5 g/l and 3 g/l Pelgrasol CSV (Fatliquor stabilised to electrolytes) was added and run for another 30 minutes (pH = 2,8-3,0). The skins remained in paddle overnight. The addition of a fatliquor to pickling proved to be of advantage because of more uniform tanning and better feel of the final product.

Tanning:- we proceeded with tanning after pickling in the same float, 2 g/l Novaltan P (aldehyde tanning agent) was added, run 30 minutes and the tannage was continued with 12 g/l chrome salt added at two 30 minutes intervals of running. After one more hour of running 5 g/l Pelgrasol CSV (fatliquor) was added, and after 4 hours of running the skins were left in paddle overnight. Next day basification to pH = 4,2 was carried out with sodium bicarbonate (dilution 1:10). If the pH-valus after 2 hours remains unchanged, the skins are unloaded.

Neutralisation: the skins were piled fot two days, and after that neutralized with 2 g/l sodium bicarbonate in water at 35°C. After 1 hour running the skins were well rinsed.

SUMMARY

After organoleptic examinations as well as chemical and physical analyses and testings, no difference in fell and quality could be found in these skins compared with those manufactured in normal production. Accordingly, sea water could be used for manufacture of seat covers and linings with the exception of the processes of colouring and fatliquoring.

4.4. The list of machinery and equipment

4.4.1. Paddles for soaking, washing, pickling and tanning - "Kostroj" M_{14}

Capacity :	l	10.000
Installed power :	KW	5,5
Floor space required:	mm x mm	4644 x 3030
Number of paddles :		6
Workers :		5

4.4.2. Hair and wool washing machine "Divota" type - 20

Working width :	m	1250
Capacity :	skins/h	50
Installed power:	KW 2+3=	5
Floor space required:	mm x mm	2600 x 1500
Number of machines :		1
Workers :		1

4.4.3. Hydraulic fleshing machine "Solčava B" type A-22

Working width :	m	1250
Capacity :	skins/h	100
Installed power :	KW	7,5
Floor space required:	mm x mm	2650 x 110
Number of machines :		1
Workers :		2

4.4.4. *Wet fur shearing machine*
"Jezerka" type Y10

Working width :	*m*	*1500*
Capacity :	*skins/h*	*100*
Installed power :	*KW*	*10*
Floor space required:	*mm x mm*	*3000 x 2485*
Number of machines :		*1*
Workers :		*2*

4.4.5. *Paddles for dyeing and fatliquoring*
"Kostroj" M_{05}

Capacity :	*l*	*5000*
Installed power :	*KW*	*4*
Floor space required:	*mm x mm*	*3700 x 2500*
Number of paddles :		*3*
Workers :		*4*

4.4.6. *Centrifuge*
"Jedinstvo" - Zagreb

Ø	*mm*	*1100*
Capacity :	*skins/h*	*300*
Installed power :	*KW*	*5,5*
Floor space required:	*mmxmm*	*2000 x 200*
Number of machines:		*1*
Workers :		*1*

4.4.7 Tunnel dryer
type H 81

Capacity :	skins/h	50
Installed power:	KW	26
Floor space required:	mmxmm	23400 x 6000
Number of dryers :		1
Workers :		2
Steam consumption :	kg/h	360
Steam pressure :	kp/cm^2	2
Steam temperature :	^oC	120

4.4.8. Sow dust drum

Capacity :	skins/h	100
Installed power :	KW	12
Floor space required:	mmxmm	5000 x 3000
Number of drums :		1

4.4.9. Sow dust removing drum

Capacity :	skins/h	100
Installed power :	KW	4
Floor space required :	mmxmm	3500 x 3300
Number of drums :		1

4.4.10. *Softening machine*
"Breg" type 07400

Working width :	*m*	*350*
Capacity :	*skins/h*	*25*
Installed power :	*KW*	*1,5*
Floor space required:	*mmxmm*	*1100 x 850*
Number of machines :		*5*
Worker/machine :		*1*
Workers total :		*5*

4.4.11. *Staking machine*
"Dravinja" type 07300

Working width :	*m*	*85*
Capacity :	*skins/h*	*65*
Installed power :	*KW*	*1,5*
Floor space required :	*mmxmm*	*800 x 800*
Number of machines :		*2*
Worker/machine :		*1*
Workers total :		*2*

4.4.12. *Staking machine*
"Selbeck" type M-SM 125

Working width :	*m*	*1250*
Capacity :	*skins/h*	*200*
Installed power :	*KW*	*5*
Floor space required:	*mmxmm*	*300 x 200*
Number of machines :		*1*
Workers :		*1*

4.4.13. *Toggle Dryer*
"Ekonom" type H 33

Sizes of frames :	*mmxmm =*	*2750 x 1500*
Capacity :	*skins/h*	*40 - 60*
Installed power :	*KW*	*4,4*
Floor space required :	*mmxmm*	*7400 x 3000*
Number of dryers :		*1*
Workers :		*8*
Steam consumption :	*kg/t*	*90*

4.4.14. *Combing machine*
"Astrahan" type 210

Working width :	*m*	*1250*
Capacity :	*skins/h*	*150 - 200*
Installed power :	*KW*	*4*
Floor space required :	*mmxmm*	*2200 x 3000*
Number of machines :		*1*
Workers :		*2*

4.4.15. *Fur shearing machine*
"Angora" type 06200

Working width :	*m*	*1250*
Capacity :	*skins/h*	*150 - 300*
Installed power :	*KW*	*6,2*
Floor space required :	*mmxmm*	*2200 x 3000*
Number of machines :		*1*
Workers :		*2*

4.4.16. *Buffing machine*
"Ideal" type D-03
with the dust collector

Working width :	*m*	*250*
Capacity :	*skins/h*	*50-70*
Installed power :	*KW*	*6,5*
Floor space required :	*mmxmm*	*1700 x 2400*
Number of machines :		*1*
Workers :		*1*

4.4.17. *Ironing machine*
"Merina" type L 22 (mechanic)

Working width :	*m*	*350*
Capacity :	*skins/h*	*20-60*
Installed power :	*KW*	*9,4*
Floor space required :	*mmxmm*	*1500 x 1500*
Number of machines :		*2 (4)*
Workers :		*1*
Workers total :		*2*

4.4.18. *Measuring machine*
"Prima" type G-01

Working width :	*m*	*1650*
Capacity :	*skins/h*	*300*
Installed power :	*KW*	*0,55*
Floor space required:	*mmxmm*	*2000 x 1200*
Number of machines :		*1*
Workers :		*1*

4.5. *The layout*

The layout of the machines and the equipment under the naumbers as in paragraph 5.4. is given in the annex I. (Design 1:100)

1. *Paddles for soaking - M_{14}*
2. *Hair and wool washing machine*
3. *Hydraulic flesking machine*
4. *Wet fur shearing machine*
5. *Paddles for dyeing - M_{05}*
6. *Centrifuge*
7. *Tunnel dryer*
8. *Sow dust drum*
9. *Sow dust removing drum*
10. *Softening machine "Breg"*
11. *Staking machine "Dravinja"*
12. *Staking machine "Selbeck"*
13. *Toggle Dryer "Ekonom"*
14. *Combing machine "Astrahan"*
15. *Fur shearing machine "Angora"*
16. *Buffing machine "Ideal"*
17. *Ironing machine "Merina"*
18. *Measuring machine "Prima"*

The necessary space is determined by the layout of machines and the process of tehnology. Together with the store for intermediate skins and finished furs necessary area amounts to 1400 m^2.

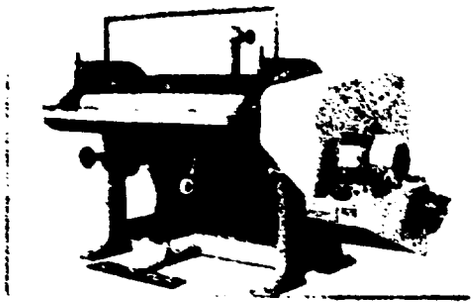
The highest machines and equipment are also determining factors for the hight of the factory building. The paddle type M_{14} is 2685 mm high. As the minimum of additional 1000 mm is necessary for manipulation, the lowest part of the building should be 3,7 m high. After the paddle, toggle dryer and tunel dryer are equipments of the similar hight.

In annex I. design of vertical section is given where paddle M_{14} and tunnel dryer are shown.

Paddle M_{14}	A	B	C	D	E	F	G	H	I	L	M	N
	3030	2585	100	1800	700	700	200	1792	1522	3244	4644	1447

Tunnel dryer	A	B	h
	6	23	2,90

In next two pages photos of the machines in wet and finishing department give the picture of the tannery.



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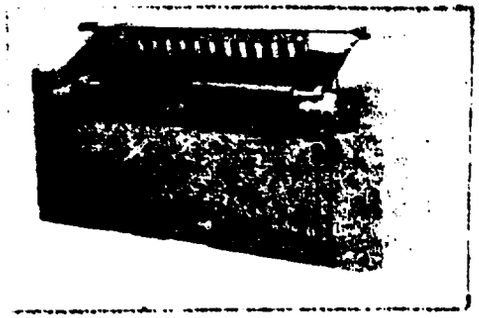

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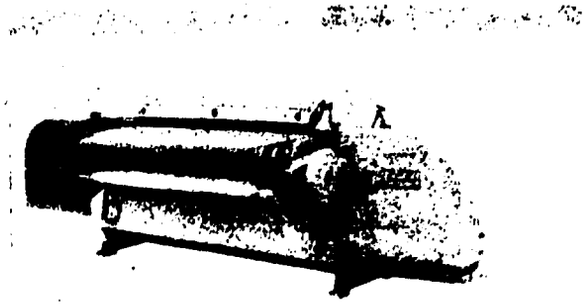

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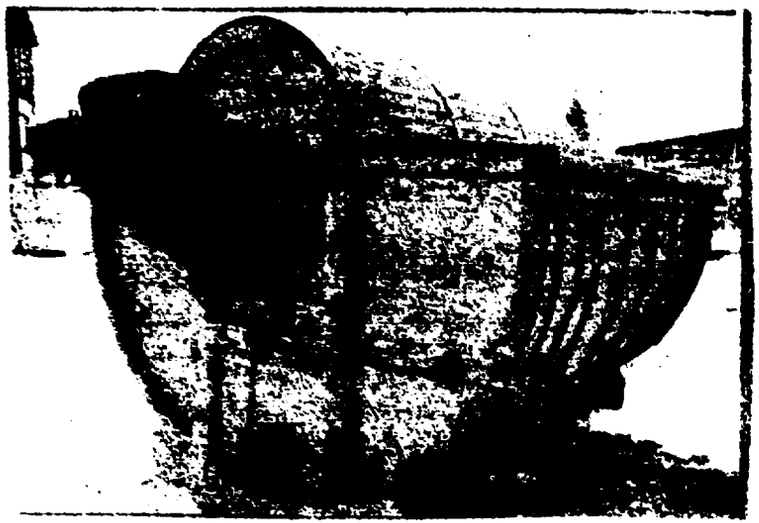

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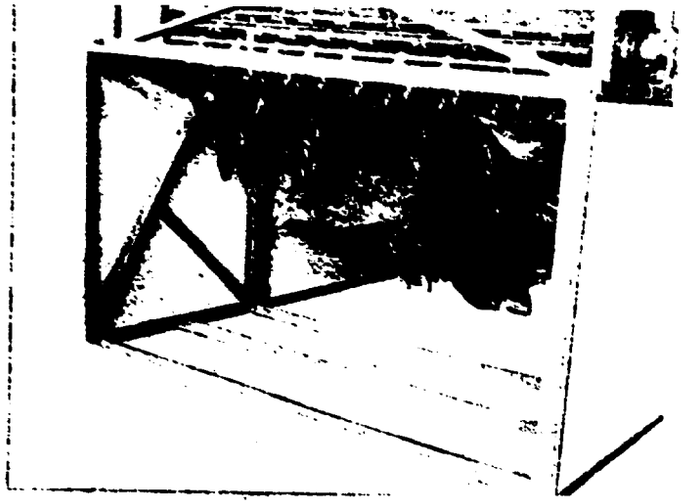

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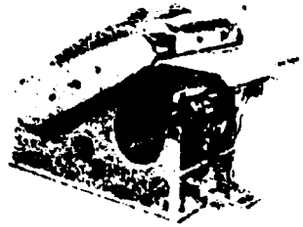

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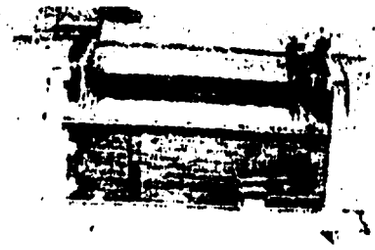

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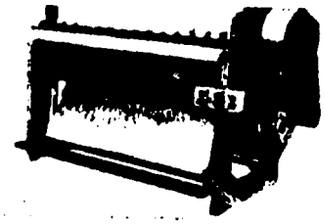

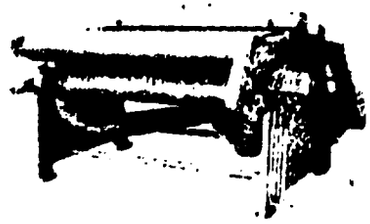

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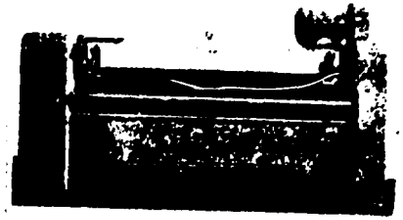

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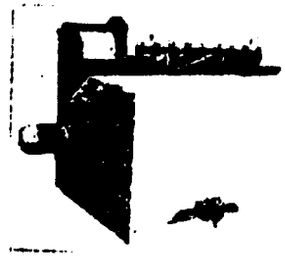

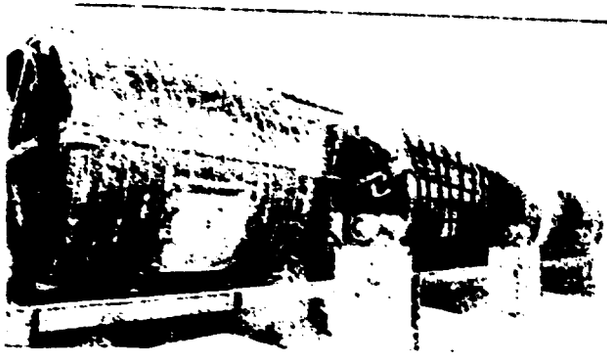

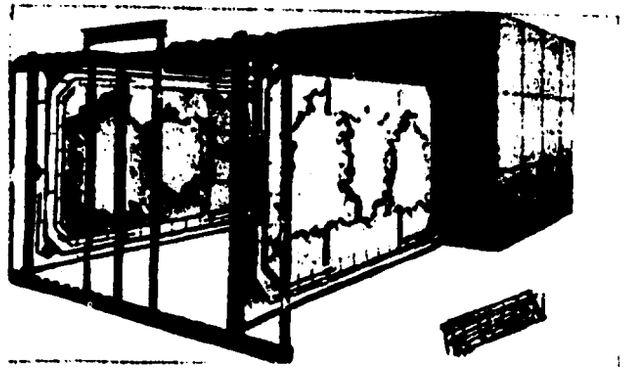

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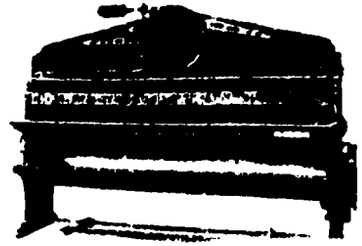

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4.6. Energy and water

The fur factory as every tannery needs electrical power and steam or warm water for dryers and for tehnological process. The tannery needs also big quantity of water.

4.6.1. Steam consumption

Steam consumption according to the manufacturing process, capacity and provided machines will be as follows.

Tunnel dryer	360 kg/h
Toggle dryer	90 kg/h
Paddles	250 kg/h
Total	700 kg/h

The steam boyler with capacity of 1000 kg/h installed in National Tanning factory with better organisation of leather production could be utilised also for fur production covering satisfactory the both productions.

4.6.2. Electric power

a) Installed power according to the list of machines and equipments

Name of machines	KW
1. Paddles for soaking - M_{14} 5,5 x 6	33
2. Hair and wool washing machine	5,0
3. Hydraulic fleshing machine	7,5
4. Wet fur shearing machine	10,0
5. Paddles for dying 4,0 x 3	12,0
6. Centrifuge	5,5
7. Tunnel dryer	26,0
8. Sow dust drum	12,0
9. Sow dust removing drum	4,0

10.	Softening machine "Breg" 1,5 x 5	7,5
11.	Staking machine "Dravinja" 1,5 x 2	3,0
12.	Staking machine "Selbeck"	5,0
13.	Toggle dryer "Ekonom"	4,4
14.	Combing machine "Astrahan"	4,0
15.	Fur shearing machine "Angora"	6,2
16.	Buffing machine "Ideal"	6,5
17.	Ironing machine "Merina" 9,4 x 2	18,8
18.	Measuring machine "Prima"	0,6
	T O T A L :	170,8 ≠ 171 KW

b) Daily consumption

171 KW x 7 h = 1.197 kw x f = 778 KWh/day.

f - factor for the simultanens use of machines = 0,65

Installed transformer of 1100 KVA will be satisfactory for the leather production where 360 KW was installed and fur production with 177 KW installed power.

4.6.3. Water

In the processing of wool sheepskins to furs about 100 l water per 1 kg of dryed or drysalted skin is used. With recycling of pickle and chrome tanning floats, amount of water could be lowered to 80 l/kg. At the same time processing of fresh skins will give an additional decrease of water consumption of 20 l/kg for soaking. So 60 l/kg of water was calculated.

The water cost of 65 fills per 100 gallons is wery high and use of saline water (paragraph 5.3.) could lower yearly costs of production for aproximately 15000 $.

4.6.4. Waste waters

There is about the same quantity of waste waters as used in technological process i.e. 120 m^3 per day. The waste waters from fur tanneries are not so harmful, as from leather production and they can be purified togather with the waste waters from leather production.

4.7. The manpower

For the planned assortment and capacity of production the following qualifications and number of workers is needed:

4.7.1. Operating labor

1.	Techincal manager	1
2.	Foreman	2
3.	Electrician	1
4.	Mechanic	1
5.	Supervisor	2
6.	De-burring	1
7.	Preparat n of auxiliary materials	1
8.	Paddles operators	4
9.	Centrifuge operator	1
10.	Fleshing	2
11.	Sammying	1
12.	Wet works	4
13.	Tunnel drying	2
14.	Continuous staking	1
15.	Staking	1
16.	Strecking on frames and drying	8
17.	Fur trimming	1
18.	Fur shearing	2
19.	Fur combing	2
20.	Fur grinding	1
21.	Fur ironing	2
22.	Fur measuring	1
	T o t a l :	46 workers

4.7.2. Training

The best possibility for training the operating labor would be in cooperation with the foreign partner. Technical manager, foreman and supervisors should be trained for their jobs through practical work and theoretical education based on their previous knowledge. Theoretical education should include the following subjects:

1. Microbiological processes in fur manufacture
2. Structure of raw skins, specially furskins
3. Methode of preservation
4. Dressing of raw furskins
5. Dying and bleaching
6. Finishing
7. Mechanical operations in furskin processing
8. Ecology
9. Control of manufacturing processes

Education should be based on discussions, demonstrations, practical work in laboratories and experimental stations, as well as participating in manufacturing processes.
Labor work could be trained by instructors and skilled technical staff in the course of 3. months. Also it should be necessary that the person responsable for technical management should be naminated by the provider of technology for a period of 1 year, and he should carry out the training as required.

4.8. Cost of investment:

In the costs of investment are included machines, equipments and building with installations for processing of 400 pieces wool sheepskins daily, together with store for intermediate and finished furs. Stores for spare parts and chemicals should be the same the tannery alredy has for leather production.
Suggested processing of fresh skins from Aden abattoir need no store for raw material.

4.8.1. The machines

	Name of machine/equipment	N.of pieces	Price per unit $	Total price $
1.	Paddles M_{14}	6	12.350	74.100
2.	"Divota"	1	10.895	10.895
3.	"Solčava"	1	14.312	14.312
4.	"Jezerka"	1	12.463	12.463
5.	Paddles M_{05}	3	9.418	28.254
6.	Centrifuge	1	22.000	22.000
7.	Tunnel dryer	1	50.967	50.967
8.	Sow dust drum	1	18.499	18.499
9.	Sow dust removing drum	1	9.893	9.893
10.	"Breg"	5	2.623	13.115
11.	"Dravinja"	2	2.150	4.300
12.	"Selbeck"	1	31.000	31.000
13.	"Ekonom"	1	28.073	28.073
14.	"Astrahan"	1	8.194	8.194
15.	"Angora"	1	10.351	10.351
16.	"Ideal"	1	9.353	9.353
17.	"Merina"	2	6.394	12.788
18.	"Prima"	1	18.720	18.720
			277.655 $	377.277 $

Prices fco Yugoslav port Rijeka

All the machines, except staking machine "Selbeck", are from "Kostroj" Yugoslavia because of good quality and reasonable price and the fact, that 80% of machines in National Tanning factory have been supplied by "Kostroj".

4.8.2. Transport of machines ..... 72.000 $

4.8.3. Installation of machines ..... 42.554 $

4.8.4. Building with installations

The layout of machines and equipment, necessary area for flow of planned production, requires the space of 1400 m^2, where also store for intermediate and finished fur was provided, at the price of 150 $ per m^2.
Total cost of building with necessary installation for energy and water will be

210.000 $

Total cost of the investmet 4.8.1 + 4.8.2. + 4.8.3. + 4.8.4. = 701.831 $

5. Financial data

5.1. Techno-economic parameters

A) Soaking capacity

The planned capacity of 10.000 pieces wool sheepskins monthly gives a capacity of 400 pieces per day on the basis of 25 working days per month.

400 pcs of drysalted skins = 2.000 kg
400 pcs of fresh skins = 3.200 kg

b) Final production

400 pcs sheepskins give 280 m^2 furs per day
10.000 pcs sheepskins give 7000 m^2 furs per month

From 7000 m^2 of furs, 5000 m^2 are the quality of car seat covers, and 2000 m^2 linings for garments and shoes.

As the final production in this study should be understood furs for linings and furs for car seat covers semi-finished and prepared for dying. As already explained it will be suggested to the National Tanning factory to enter in a co-operation with an European enterprise, because of know-how transfering and marketing. The market for the furs, especially for car seat covers is in Europe, and it is not possible to follow demand for new shapes in colours and sizes without such a co-operation.

	Month (m^2 25 days)	Year (m^2 12 month)
Seat car covers	5000	60000
Linings	2000	24000
T o t a l :	7000	84000

5.2. Production costs

Production costs are given separately for car seat covers and linings.

a) Calculation for 1 m^2 fur for seat covers in US $

1.	Raw sheepskins	1,55 $
2.	Chemicals	2,50
3.	General expenses and overhead costs	0,67
4.	Operating labor costs	1,65
5.	Amortization : building + equipment	0,67
6.	Interests	0,65
7.	Profit	1,31
8.	Selling price	9,00

b) Calculation for 1 m^2 of for lining in US $

1.	Raw sheepskins	1,55 $
2.	Chemicals	1,51
3.	General expenses and overhead costs	0,46
4.	Operating labor costs	1,10
5.	Amortization: building + equipment	0,67
6.	Interests	0,65
7.	Profit	0,85
8.	Selling price	6,80

5.3. List of chemicals

5.3.1. Necessary chemicals for production of 100 m^2 furs for seat covers

1.	Common salt	100
2.	Soda (anhydrous)	7
3.	Formic acid	16
4.	Enzyme bate agent	8
5.	Tanning agent	18
6.	Re-tanning agent	2
7.	Fur dyestuffs	1,7
8.	Trichlorethylene	15
9.	Alcohol	1,5
10.	Fat-liquoring agent	18
11.	Bleaching agent	6
12.	Wetting agents	50
13.	Finishing agents	4

5.3.2. Necessary chemicals for production of 100 m^2 fur linings

1.	Common salt	100 kg
2.	Soda (anhydrous)	10
3.	Enzyme bate agent	8
4.	Formic acid	12
5.	Tanning agent	18
6.	Bleaching agent	6
7.	Wetting agents	6
8.	Petrol	6
9.	Fatliquoring agents	14
10.	Finishing agents	1

5.4. Sales and profit

From paragraphe 5.1. and 5.2. is possible to determine the sales, profit and net foreign exchange earnings.

5.4.1. Total sales

in US $

Structure of price	Car seat covers		Fur linings		Total
	Total	1 m^2	Total	1 m^2	Total amount
1. Raw sheepskins	93.000	1,55	37.200	1,55	130.200
2. Chemicals	150.000	2,50	36.240	1,51	186.240
3. General expenses and overhead costs	40.200	0,67	11.040	0,46	51.240
4. Operating labor costs	99.000	1,65	26.400	1,10	125.400
5. Amortization: building + equipment	40.220	0,67	15.983	0,67	56.183
6. Interests	39.000	0,65	15.920	0,65	54.920
7. Profit	78.600	1,31	20.417	0,85	99.017
8. Selling price	540.000	9,00	163.200	6,80	703.200

5.4.2. Net foreign exchange earnings

As in the chapter 8 is explained all quantity of furs will be exported, so total sales of 703.200 $ will be also foreign exchange earnings. This amount will be decreased for the amount of purchased chemicals.

Chemicals for seat covers	m^2 60.000 x 2,5 $	=	150.000 $
Chemicals for linings	m^2 24.000 x 1,515 $	=	36.240 $
T o t a l		=	186.240 $

Net foreign exchange earnings spare parts not inculded ..... 703.200 $ - 186.240 $ = 516.960 $

5.5. Financial structure

5.5.1. Financial structure of investment

Buildings	210.000 $
Equipment	491.831 $
Working capital	80.000 $
T o t a l capital :	781.831

5.5.2. Financial conditions

	Amount of credit $	N.of years	Yearly payment $	Yearly interests % (average)	$
Buildings	210.000	30	7.000	8	11.654
Equipment	491.831	10	49.183	10	30.860
Working capital	80.000	10	8.000	24	12.406
T o t a l			64.183		54.920

5.5.3. *Financial structure of the production*

Raw sheepskins	18,5 %
Chemicals	26,6
General expenses and overhead costs	7,3
Operating labor costs	17,8
Amortization and interests	15,8
Profit	14,0

5.5.4. *Financial parameters of investment*

With the selling prices from paragraphe 5.2. is possible to return the capital as folows:

30 years for buildings
10 years for equipment
10 years for working capital

Yearly payment of 64.183 $ will be covered with the amortization of 56.183 $ and with 8.000 $ from the profit.
Net profit after this payment amounts 91.017 $.

Gross income of 703.200 $ yearly will be realized with 46 workers or 15.287 $ per worker.

6. Conclusions

a) During th· stay of our experts in PDR Yemen in Octobar 1984. it was found that the method now used for the curing of Australian sheepskins is the cause of great loss in their quality. A great percentage of so cured sheepskins is practically useless (reejects) and sold at very low prices.

Along with the recommendation of establishing a factory for the manufacture of these skins it must be mentioned that the curing should be omitted. The production should be based on dayly output of sheepskins from the slaughter-house.

Drying of skins is the cause of many faults resulting in poor quality of finished furskins. During the process of drying certain parts of skins are lost and the yield is poor. Menufacture of freshe skins will give better quality and diminish consumption of chemicals and water for soaking.

b) Because of defficiency of fresh water and its high price, for the production of furskins the great advantage would be the use of sea water. Research works in this study confirm the possibility of use of sea water for all processes except dyeing.

c) The finished furskins, especially for seat-cover , should be exported to European and partly US market. That is the reason for the cooperation with an European partner obliged to finish uncoloured furskins and manufacture them to seat covers according to the market demands.

d) The results of this study could be the basis for deciding about the investment in a furskins factory. After the final decision, in a separate investment programme all the variable aspects of investment should be examined in detail, especially prices. The use of some leather factory buildings and existing infrastructure facilities should also be taken in consideration.

e) The furskins factory of Tehnološki Centar Karlovac with many years of experiance in sheepskins processing as well as in manufacturing and export of seat covers, is willing to cooperate as it is stated in point 8c. A long-term contract for cooperation would include transfer of technology, without separate charges for know-how, except the expenses of experts responsable for managing the factory at the beginning of production.

7. Recommendation

The investments in the furskins factory are recommended because of great losses caused by the present state. In point 5. the possibilities for export, foreign earnings and profit are given.

Preliminary to realization of investment all the alternatives should be discussed an well as the possibility of a joint venture.

OUR TEHNOLOSKI CENTAR
KARLOVAC
RJ RAZVOJ
POKUSNA STANICA

ANNEX II

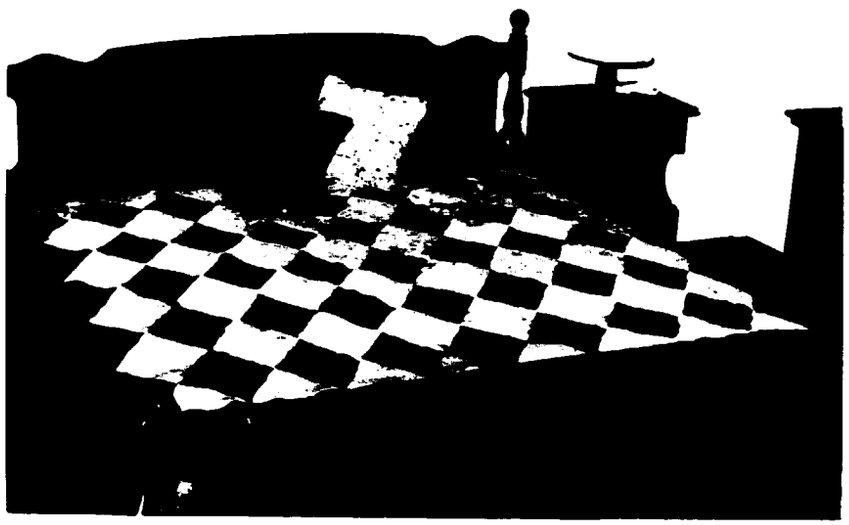
SHOE LININGS FUR

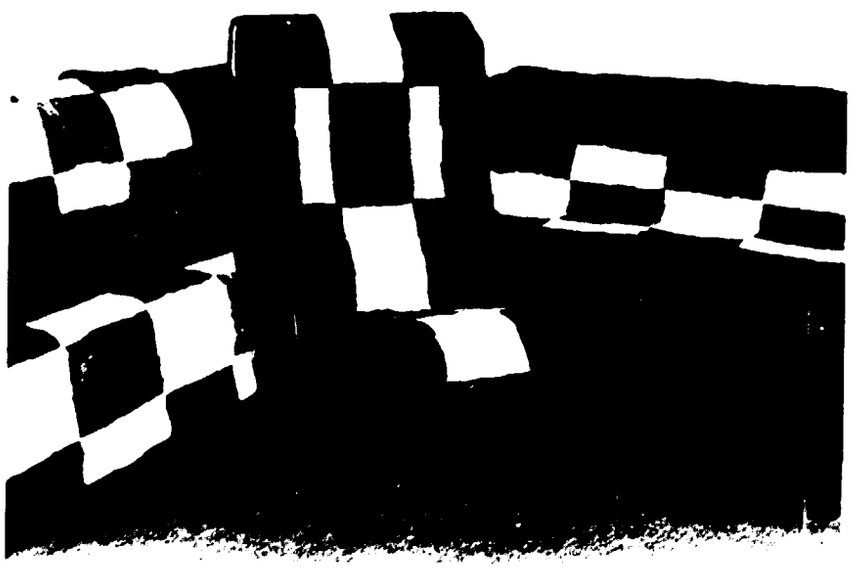
PROCESSED IN
SALINE WATER

CAR SEAT COVERS

OUR TEHNOLOŠKI CENTAR
K A R L O V A C
RJ RAZVOJ
POKUSNA STANICA

ANNEX III





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