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UNIDO Contract No. 86/06
Project No. SI/ETH/85/802
Activity Code: SI/ETH/31.7.C

FINAL REPORT

ON

ASSISTANCE IN THE ESTABLISHMENT
OF A NATIONAL UTILIZATION SCHEME
FOR SLAUGHTERHOUSE BY-PRODUCTS

IN

ETHIOPIA

December 1986

This FINAL REPORT comprises this cover page, a table of contents,
241 pages of text and 3 annexes

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CHAPTER 1

BACKGROUND AND HISTORY OF THE PROJECT

Reference:	UNIDO CONTRACT No. 86/06 Project No. SI/ETH/85/802 Acticity Code: SI/ETH/31.7.C
Employer:	THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO) Wagramerstrasse 05 A - 1220 Vienna Austria
Contractor:	VEB AGRO-CONSULT DRESDEN Karcherallee 49 Dresden 8 0 2 0 GDR
Ethiopian Counterpart:	LIVESTOCK DEVELOPMENT AND MEAT CORPORATION (LIMCOR) P. O Box 5579 Addis Ababa Ethiopia
Consulting Team:	Mr. Meier, Team Leader Mrs. Prof. Schuetze, Industry Economist Mr. Gruenberg, Project Engineer Mr. Fregin, Industry Engineer
Field Work:	May 21st to July 10th, 1986, Ethiopia

Objective

In conformity with the contract No 86/06 between the UNIDO Vienna and veb agro-consult dresden the employer had the task to assess and evalute slaughterhouse operation in Ethiopia with particular regard to kinds, quantities, and quality of produced by-products and offals, and to describe their present and potential use in food processing industry and other respective industries.
This order was defined and placed in coordination between the government of Ethiopia and the UNIDO, and meets the objective of the Ethiopian government to mobilize and develop all existing resources consequently for optimum use of raw materials by the national industry.

Execution of the order

A team of four experts of veb agro-consult dresden has inspected the sites necessary for this report during seven-week field work in Ethiopia, had discussions with the Ethiopian counterpart and other authorities as well as collected respective data and information.
The objective and the organization and contents of field works were coordinated with the permanent representative of the UNIDO in Addis Ababa as well as with the Ethiopian counterpart at the beginning of work.
On June 16th, 1986 a written interim report on the State of execution of the order was delivered to the UNIDO representative.
There were no problems during preparation and execution of the field works. Field work could be done to its full extent and exactly in conformity with the working plan coordinated with the UNIDO representative and the counterpart.
In this connection the authors of this report would like to express their heartfelt thanks to the UNIDO representative in Addis Ababa as well as to the Ethiopian counterpart for the excellent support given during the whole period of field works.

CHAPTER 2

SUMMARY AND CONCLUSIONS

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2.01 General explanation

2.02 Summary and conclusions

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2.01 Summary of project proposals

2.02 Outline of obtainable production results

2.01. General explanation

Task of the consultant was to draft a national utilization pattern for better use of slaughterhouse by-products.
The authors of this study were guided by the considerations to comprise at first all reserves in existing slaughterhouses and by-product processing plants. On this basis modification suggestions for each of the visited enterprises are made, aiming at considerable economic improvement of the financial production results with the lowest possible capital expenditure and shown in the chapters 7 and 8.
Thereby it is also recommended to put the proposed modification suggestions into practice at short notice and to apply for support by the UNIDO, if necessary.
Setting-up of new by-product processing plants at Debre Zeyt, Dire Dawa, and Addis Ababa should be prepared in a second stage and based on detailed feasibility studies.

2.02. Summary and conclusions

SUMMARY

Table 2.01 gives a summary on the proposed modifications and the investment measures and their timely executability.

Besides the solution of technical problems it should be recommendable to make practicable the following administrative measures:

1. Exchange of experience between the slaughterhouses (managing director, production manager, technical manager)
2. Elaboration of a study on the present and future fodder demand and on the development of the fodder industry in Ethiopia (with UNIDO-support)
3. Juridical and organizational take over of the city-slaughterhouses in Dire Dawa, Asmara, Gondar and Kombolcha in the responsibility of LIMCOR and closing of the city-slaughterhouses, for hygienic reasons soonest possible
4. Elaboration of a study on the efficiency of the present animal purchase system and formulation of organizational and juridical measures for its considerable improvement with the aim to increase the rate of utilization of the existing slaughterhouses and to obtain herewith by-products.

CONCLUSIONS

By putting into practice of the proposed modification suggestions for existing production plants considerable economic results could be achieved.

In the very field of modifications altogether 5.4 million birr of extra profit could be gained per year with the capital expenditure of 0.85 million birr.

For reasons of the existing local price structure new investments are profitable as independent economic unities only if they are supported by the State.

Nevertheless, they are an indispensable part of the whole system of by-product processing, contribute to the solution of the whole problem, and have their part in the possible gain of foreign currency as well

as in covering of the local demand for final products from by-product processing.

Table 2.02 gives a general idea of total results which may be obtained in this sector.
All export proceeds which seem to be possible amounting tc US $ 5.52 million per year justify improved utilization of obtained slaughtering by-products.

Table 2.01

Summary of project proposals

No	proposal	time table 87 88 89 90 91 92 93 94 95 96	activities
1	Processing of bone pile in Addis Ababa City Slaughterhouse	.....	Projectpreparation Municipality, UNIDO Consultant Projectexecution Municipality, UNDP
2	Winning of intestines, blood, plasma and glands in all of the slaughterhouses	.....	Projectpreparation LIMCOR, Municipalities UNIDO/UNDP Consultant Projectexecution LIMCOR, Municipalities UNIDO/UNDP
3	Organizational measures for sausage production which concern the range of production in Kaliti and Asmara (Horticulture)	———	Projectpreparation LIMCOR, Ministry of Agriculture Consultant (for recipies) Projectexecution LIMCOR, Ministry of Agriculture Consultant

Table 2.01

Summary of project proposals

No	proposal	time table 87	88	89	90	91	92	93	94	95	96	activities
4	Measures for sausage production which require further equipment in Malge Wondo, INCODE Asmara, Dire Dawa, Gondar	.....										Projectpreparation LIMCOR, Consultant, UNIDO/UNDP Projectexecution LIMCOR, UNIDO/UNDP Consultant
5	Reduction of coldstorage shrinkage in Gondar Meat Factory	.....										Projectpreparation LIMCOR, UNIDO/UNDP Supplier of cold store equipments Projectexecution LIMCOR, Supplier of cold store equipments
6	Reduction of coldstorage shrinkage in Asmara INCODE Slaughterhouse	.....										like item 5
7	Improvement of skin quality by skinning devices in all slaughterhouses except Dire Dawa	.....										Projectpreparation LIMCOR, UNIDO/UNDP Supplier of equipment Projectexecution LIMCOR, UNIDO/UNDP Supplier of equipment

Table 2.01

Summary of project proposals

No	proposal	time table 87 88 89 90 91 92 93 94 95 96	activities
8	Erection of new dump grounds for manure in all slaughterhouses	...	Projectpreparation and -execution LIMCOR, Municipalities
9	Erection of new by-product processing plants at Debre Zeyt and Dire Dawa		Responsibility LIMCOR
	feasibility study		UNIDO/Consultant
	project documents		Supplier
	execution		LIMCOR, Supplier
	putting into operation		LIMCOR, Supplier
10	Central by-product processing plant in Addis Ababa		Responsibility LIMCOR
	feasibility study		UNIDO/Consultant
	project documents		Supplier
	execution		LIMCOR, Supplier
	putting into operation		LIMCOR, Supplier

Table 2.01

Summary of project proposals

No	proposal	time table	activities
		87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96	
11	Alternativly to the central by-product processing plant erection of a new slaughterhouse with by-product processing plant at Addis Ababa		Responsibility: Municipality of Addis Ababa
	feasibility study	———	UNIDO/Consultant
	project documents	———	Supplier
	execution	———	Municipal, Supplier
	putting into operation	———	Municipal, Supplier

Industrial use (modifications and new plants)

Table 2.02

Outline of obtainable production results

Product	Production capacity		Home demands		Exportation	
	actual level	after putting into practice of the suggestions	actual level	after putting into practice of the suggestions	actual level	after putting into practice of the suggestions
animal body meal	4,660 t/a	13,900 t/a	2,660 t/a	5,000 t/a	2,000 t/a	8,900 t/a 1.8 Mio $/a
intestines	200,000 m/a	29,270,000 m/a	200,000 m/a	1,270,000 m/a	-	28,000,000 m/a 1.12 Mio $/a
glands	-	300 t/a	-	-	-	300 t/a 0.6 Mio $/a
industrial greases	1,770 t/a	5,450 t/a	1,770 t/a	5,450 t/a	-	- *1
compost	2,820 t/a	30,000 t/a	2,820 t/a	30,000 t/a	-	-
organic fertilizer	-	20,000 t/a	very high	20,000 t/a	-	- *1
				export proceeds:		3.52 Mio $/a
				plus organic fertilizer:		2.00 Mio $/a
				total		5.52 Mio $/a

*1 exportation alternatively possible
When fixing production capacity for animal body meal and organic fertilizer, it has been supposed that the bone pile at Addis Ababa (estimated at 170,000 t) will be removed within 10 - 15 years.
1st stage: Installation of a bone crusher at the City Slaughterhouse = 6,600 t of bone meal
2nd stage: After setting into operation of the Central By-product Processing Plant, processing of 15,000 t/a of bones = 7,500 t of bone meal

CHAPTER 3

ECONOMIC AND MARKET ANALYSIS OF THE MEAT INDUSTRY

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3.07. Export market

Tables:

3.03 By-products of slaughtering process and yield per head
3.04 Visited plants
3.06 Review of annual yield of usable by-products
3.07 Review of export

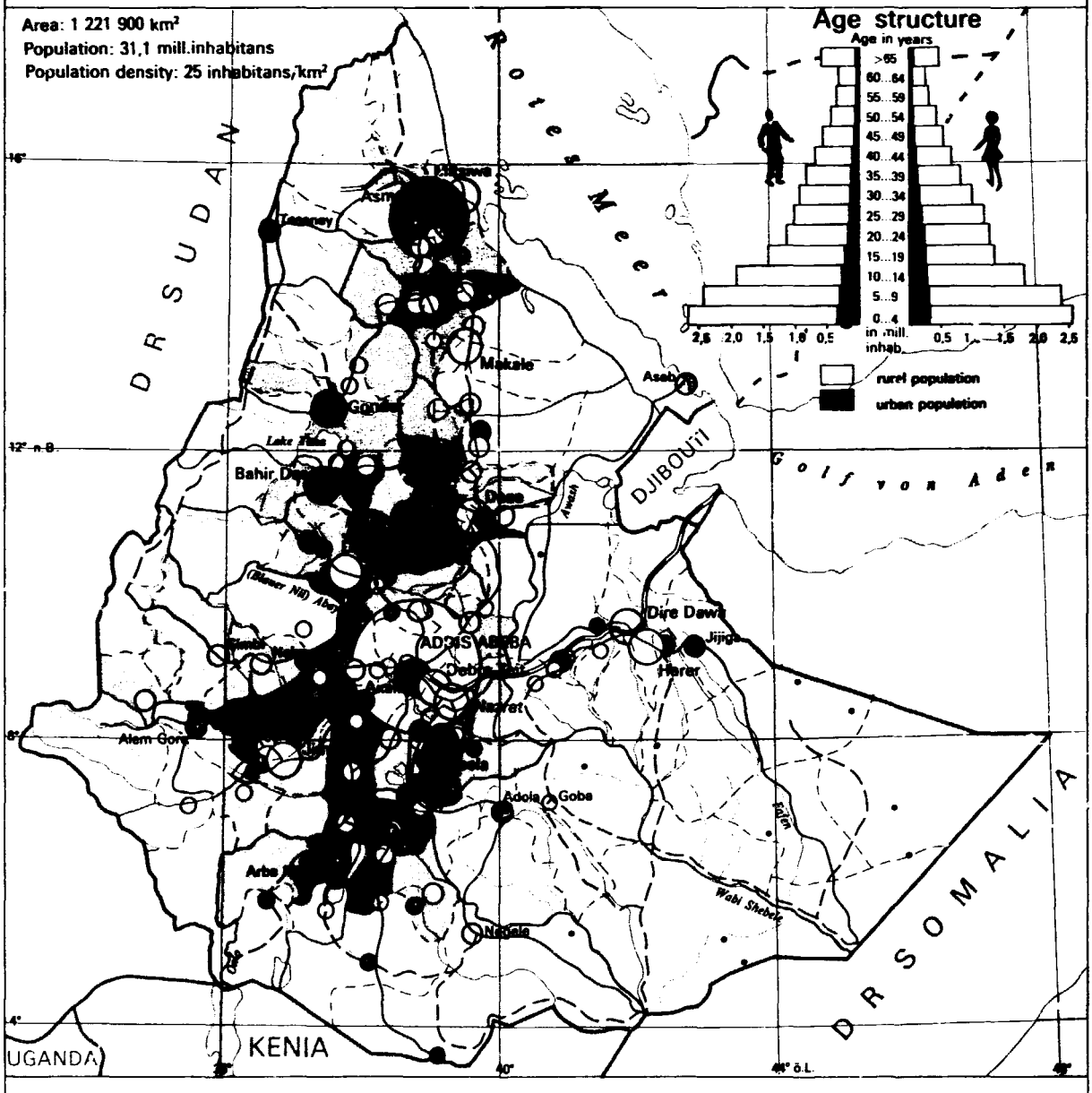
3.01. Data concerning the population

At present Ethiopia has about 42 million inhabitants.
The demographic evolution has been very quick during the last few years. With an annual growth rate of 3 - 3.5 % there will be another considerable absolute increase in population until 1995. Besides the trend towards a relative increase of urban population compared with the total population continues to mount. This results in new requirements of supply because the proportion of people working in agriculture diminishes at the same time with higher concentration of population and increasing industrialization of national economy. Even if 90 % of employable people are still working in the agricultural sector at present and able to produce themselves their supply of vegetable and animal food, this percentage will diminish in the next 10 years.
The enclosed map of population distribution shows striking territorial differences which are expected to undergo only insignificant changes until 1990. The highest population density is to be recorded in the central highlands.
Based on the development of new industrial and agricultural projects scheduled in the ten-year plan on the development of Ethiopian national economy new locally restricted areas of industrial concentration will emerge in certain provinces and gain importance in supply policy.

ETHIOPIA Population 1980

acd

Area: 1 221 900 km²
Population: 31,1 mill.inhabitans
Population density: 25 inhabitans/km²



Cities 1980 (inhabitans)

6 000...< 10 000
10 000...< 30 000
30 000...<100 000
425 000
1 200 000

Density of the rural population
(awrajas related)

0 10 25 50 75 100 150 inhab./km²

Growth of the cities 1970 - 1980

20 50 60 70 80 90 120 200 %

Traffic

all weather road
dry weather road
railway

Borders

state frontier
province borderline
awraja borderline

ADDIS ABEBA capital
oasis

0 100 200 300km

Scale 1:10 000 000

Prepared for agro-consult dresden by University of Technology Dresden, Section Geodesy and Cartography

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3.02. Livestock, animal keeping

The Ethiopian livestock ranks among the highest in Africa. According to statements of the Ministry of Agriculture the present stock of cattle is estimated at 27 million, the stock of sheep, at 24 millions, and the stock of goats, at 18 millions.
Slaughtering rates amount to

for cattle: 7 % per year = 1.9 million per year
for sheep: 33 % per year = 7.9 million per year
for goats: 37 % per year = 6.7 million per year

Meat production totals about 415,000 t/a (equal to 13-14 kg/ head of population) and should be increased to 800.000 t/a until 1995.
The strong decline of livestock caused by the extreme drought in the early eighties can be recompensated only step by step.
Animal keeping is characterized by extensive pasturing on private or cooperative basis. High-quality concentrate feedstuffs are not fed under these conditions. Parasitic animal diseases leading to a high degree of condemned organs are very common. Damages of animal skins and hides are very often to be found.
The ten-year plan includes setting up of State farms and intensive animal keeping.
In the sphere of responsibility of the Ethiopian Livestock Development and Meat Corporation farms with the following capacities are planned:

Kombolcha: 29,930 beef cattle/year with a live weight of 300 kg, comprising 14,930 for live export and 15,000 for processing

Dire Dawa: 79,205 beef cattle/year with a live weight of 300 kg, comprising 19,205 for live export and 60,000 for processing

Malge Wondo: 99,006 beef cattle/year with a live weight of 255 kg, comprising 19,006 for live export and 80,000 for processing

Debre Zeyt: 143,56/ highland sheep with a live weight of 23-27 kg from farms around Sheneka and Dinkiti

Jijiga: 17,255 beef cattle/year for processing in a new Slaughterhouse, individual by-product processing plant.

Depending on traditional eating habits sheep and goats are almost exclusively home-slaughtered. For cattle the proportion of domestic slaughtering or slaughtering by private butchers amounts to about 75 % of total slaughtering.

3.03. Definition of by-products and yield per species

The definition of the concept of by-products has no internationally binding standardization. Based on the eating habits of the population and the applied slaughtering and processing technologies the definition has to be made specifically to the country.
Referring to the situation in Ethiopia and taking the objective into account to supply all parts of the body and organs of an animal to processing the author of this report regards by agreement with LIMCOR, the following organs and parts of the animal body as by-products from the slaughtering process (table 3.03.):

Live weight of animals, in particular of cattle, varies between 220 and 340 kg/animal depending on race, feeding, keeping region, and type of keeping. This report is based on an average live weight of cattle of 290 kg for private consumption at home and 320 kg for export purposes, and of 30.0 kg for sheep. The average weight of by-products of cattle amounts to 167.62 kg/animal (without contents of stomachs and intestines) and of sheep to 15.68 kg/animal.
The average live weights of cattle and sheep as well as the respective organ weights are partially founded on statistical reports of LIMCOR. Partially they were determined by sample slaughtering in the course of field works.
Final products from industrial processing of by-products are for the most part:

bone meal
blood and meat meal
horn meal
gelatin
industrial fat
fertilizers

Table No. 3.03

By-products of slaughtering process and yield per head

By-product	Average weight Cattle (kg)	Sheep (kg)
Liver	4.7	0.5
Kidneys	1.3	0.1
Spleen	1.1	0.1
Heart	1.4	0.1
Lung	4.8	0.4
Windpipe	0.4	0.1
Stomachs	15.2	2.0
Head	10.3	1.6
Tongue	1.4	0.1
Brain	0.3	0.1
Mask and mouth	3.2	0.6
Udder	1.2	0.1
Spinal marrow	0.1	-
Pancreas	0.2	
Suprarenal body	0.05	0.04
Gall	0.3	
Gallbladder peel	0.02	
Ear ends	0.05	-
Tail	0.1	-
Horn	0.5	0.04
Lower legs	6.0	0.5
Confiscates	8.5	1.3
Tallow	11.0	-
Fooder blood	13.0	1.2
Industrial blood	2.0	0.8
Intestines	7.7	3.5
Skin	22.0	2.5
Contents of stomachs and intestines	41.0	1.5
Bones	40.0	not recorded
Sinews	9.8	not recorded
Cutting-up losses	1.0	not recorded
total	208.62	17.18

3.04. Visited plants

To get a general idea being as complete as possible of the present situation in Ethiopian slaughterhouses and by-product processing plants in the course of field works we visited the following sites. The Makalla Slaughterhouse was not included in the program of visits by agreement with LIMCOR because this enterprise has not slaughtered any more for years and will not slaughter in the near future.

Table No. 3.04.

Visited plants

Cons. No.	Site	Name of the plant	Functional description	Capacity* (animals/a)	Responsibility
1	Addis Ababa	Meat Concentrate	meat processing	-	LIMCOR
2	Addis Ababa	City Slaughterhouse	slaughterhouse with by-product processing plant	cattle 150,000 sheep, goat 57,700	municipal authorities of Addis Ababa
3	Addis Ababa	Satellite Slaughterhouse	minimum-sized slaughterhouses	cattle 158,000	Ministry of Agriculture (butcher's cooperatives)
4	Debre Zeyt	Slaughterhouse Debre Zeyt	slaughterhouse	cattle 20,000 sheep 15,600	LIMCOR
5	Malge Wondo	ELIDCO Meat Factory	slaughterhouse with meat processing and by-product processing plant	cattle 66,000	LIMCOR
6	Asmara	SOPRAL Meat Factory	slaughterhouse with meat processing and by-product processing plant	slaughterhouse and by-product processing plant out of service for 12 years	LIMCOR
7	Asmara	INCODE Slaughterhouse	slaughterhouse with by-product processing plant	cattle 17,500	LIMCOR
8	Asmara	City Slaughterhouse	slaughterhouse	cattle 20,000	municipal authorities of Asmara

Table No. 3.04.

Visited plants

Cons. No.	Site	Name of the plant	Functional description	Capacity* (animals/a)	Responsibility
9	Asmara	SOPRAL Sariche Canning Factory	Canning	-	LIMCOR
10	Asmara	Meat Factory	meat and sausage factory	-	Horticulture Corporation
11	Kombolcha	SOPRAL Meat Factory	slaughterhouse with by-product processing plant	cattle 19,900	LIMCOR
12	Dire Dawa	Meat Factory	slaughterhouse with meat processing	cattle 15,000	LIMCOR
13	Dire Dawa	City Slaughterhouse	slaughterhouse	cattle 13,200	municipal authorities of Dire Dawa
14	Gondar	Meat Factory	slaughterhouse with meat processing and by-product processing plant	cattle 10,000	LIMCOR
15	Gondar	City Slaughterhouse	slaughterhouse	cattle 8,000	municipal authorities of Dire Dawa

* Capacities shown in this table correspond to the number of animals slaughtered on an average per year during the period of inquiry (plan year 85/86) and, at the same time, they form the basis of all calculations within this final draft reports in coordination with LIMCOR.

3.05. Range of Products LIMCOR

By means of the production plants mentioned under item 3.04. the Ethiopian Livestock and Meat Corporation is able to make the following products for the home market and export purposes:

Range of products:

1. Beef Chilled or Frozen

   1.1. Beef Carcasses
   1.2. Beef Cuts
   1.3. Boneless Cooked Frozen Beef
   1.4. Pistola
   1.5. Carcass Cuts in Quarters

2. Mutton Chilled or Frozen

   2.1. Mutton in Quarters (in cartons)
   2.2. Mutton Carcass Stockinated

3. Other Edible Fresh Beef and Mutton Offals

   3.1. Tongue
   3.2. Tripe
   3.3. Liver
   3.4. Kidney

4. By-products

   4.1. Sheep Casings
   4.2. Bone and Meat Meal
   4.3. Gall Stone
   4.4. Horns and Hooves
   4.5. Hides and Skins

5. Canned Meat Products

   5.1. Zighini Watt
   5.2. Corned Beef
   5.3. Corned Mutton
   5.4. Luncheon Meat
   5.5. Spicy Minced Beef Stock
   5.6. Beef in Jelly
   5.7. Goulash

5.8. Stewed Steak

5.9. Cooked Meat Minced or Cut in Aluminium Pouches

5.10. Tripe in Brine

5.11. Fish with Vegetable Stew

6. Sausages and Other Meat Products

6.1. Frankfurter Sausages

6.2. Dibetic Sausages

6.3. Cocktail Sausages

6.4. Hotdogs

6.5. Morvian Clobase

6.6. Knackwurst Sausage

6.7. Frying Sausages

6.8. Paris/Bologna Salami

6.9. Ham

6.10. Mortadella

6.11. Dry Salami

6.12. Smoked Loin, Tail, Ribs, Neck, Tongue

7. Canned Vegetable and Fruit Products

7.1. Foul Madames

7.2. Green Beans

7.3. Shiro Watt

7.4. Tomato Paste

7.5. Tomato Juice

7.6. Peeled Tomatoes

7.7. Tomato Ketch-up

7.8. Jam and Marmelade

7.9. Orange Juice

7.10. Mixed Fruit Salad

7.11. Sweet Pepper in Vinegar

7.12. Onion in Vinegar

7.13. Borlotti Bean in Brine

7.14. Chanellini Bean in Brine

7.15. Pineapple Sliced

7.16. Pineapple Cubed

7.17. Pineapple Juice

7.18. Chick Peas

7.19. Lentils

7.20. Cubed Mixed Vegetable in Brine

7.21. Vegetable Soup

7.22. Cucumber in Vinegar

7.23. Artichoke in Vinegar

3.06. Present use of by-products

Table No 3.06

Review of annual yield of usable by-products

Species	Slaughters per year total (million)	in existing slaughter-houses (million)	By-Products per animal (t)	By-products per year total (t)	at present collectable in slaughter-houses (t)	(%)
cattle	1.9	0.498	0.168	319,200	83,762	26
sheep	7.9	0.075	0.016	126,400	1,220	0.5
goat	6.7		0.016	107,200		
			total	552,800	84,982	

Asses, mules, horses, and pigs have not been recorded because no reliable data were available.

Of the 552,800 t of by-products which are annually obtained in the whole country at present only 84,982 t are collected through the existing slaughterhouse capacities. This is a proportion of about 15 % of the total yield.

Actual use at present: 56,745 t = 10 %
comprising for human consumption: 7,801 t
and for industrial use: 48,944 t.

By starting of the slaughterhouse at Jijiga scheduled in the perspective plan period (capacity of 17,255 cattle/a) the overall balance will not change considerable.

The only conclusion can be to reduce the percentage of domestic slaughtering permanently by more efficient purchasing methods for store animals in order to win additional by-products as well as to develop a purchasing system for by-products obtained by domestic slaughtering also in future.

First of all this refers to the region of Addis Ababa.
Besides quantitative collection of by-products also qualitative evaluation is of importance.
In principle two main purposes may be marked:

a) for human consumption
b) for industrial processing.

It must be pointed out that consumption of offals both of cattle and also of sheep and goat is not very common. There are regional differences, but direct consumption of organs does not meet the eating habits of the majority of the population. For that reason the use of organs in sausage production is recommended for the moment. Such new or modified products should be introduced through the army, hospitals, and other public consumers and offered to the individual consumer in a second stage.
For industrial processing of by-products which cannot be used for human consumption existing by-product processing plants (in some cases after appropriate modification) have to be used as well as new plants which have to be set up.
Detailed suggestions are made in chapter 7, 8, and 10.

3.07. Export market

Present situation

Apart from exportation of live animals at present only skins and hides as well as frozen or canned meat are of importance for export in the sector of slaughtering and processing industry.

Table No. 3.07

Review of export

Year	Livestock (t)	Meat, frozen and canned (t)	Skins and hides (t)
1980	4,125	3,328	8,589
1981	2,571	2,329	10,167
1982	4,038	1,259	8,797
1983	5,208	3,633	8,881
1984	6,000	2,335	9,565

Exportation of skins and hides is of considerable importance for the national economy and reached with 108 million birr in 1985 about 1/5 of the value volume of coffee exports.
Depending on qualitative differences skins and hides are classified into seven categories which yield sales proceeds from US $ 35.- to 70.- per dozen hides.
For that reason more attention has to be payed to high-quality winning of skins and hides in order to increase sales proceeds already with a constant number of animals. This can be achieved e. g. by the use of machanical skinning devices.
Permanent trade relations for exportation of fresh meat (frozen) exist particulary to various Arab countries (Saudi Arabia, People's Democratic Republic of Yemen, Yemen Arab Republic, Djibouti, United Arab Emirates). Canned meat is delivered first of all to Italy (partially reexportation), in part to Japan. Other exports, especially to the European region, are of sporadic character.

Sausage exports are limited to Salami. They are of only minor extend and occur from time to time.
Exportation of final products from by-product processing (meat and blood meal as well as bone meal) is also discontinous and of low volume.
Intestines, glands, and organs are not exported.

Recommendations

With LIMCOR the Market Research Department is responsible for coordination of export activities. At present only one person works there. In connection with the objective need concerning finding and maintaining of new and permanent markets for LIMCOR export products extension of staff is strongly recommended in this department.
At present the following prices can be obtained for by-products on the world market:

bone meal	US $	205.5 per t
meat and blood meal	US $	195.0 per t
intestines	US $	4.0 per 100 m
technical grease	US $	732.0 per t
glands	US $	2,440 per t

Sales prospects are potentially good on European and Arabian markets. Apart from direct sale this products also offer the possibility of being used as compensation for obtained credits.

After putting into practice of the suggestions made in this study it would be possible that besides the recognizable home demand such a quantity of final products from by-product processing would be available to obtain export proceeds of more than US $ 3.52 million per year or even more than US $ 5.52 per year in the case of exportation of organic fertilizer (see chapter 2 and chapter 9).
Because of the lack of time during the field work it was not possible for the author to get detailed data on present and future demands for mixed feed for existing and planned animal production plants and individual farms.
For that reason is would be recommended to elaborate a detailed study on present and prospective demands for mixed feed for the Ethiopian market and for exportation at some future time and possibly with support of the UNIDO. Subject of this investigation would be also exact determination of demand for blood, bone, and horn meal, fats, etc for utilization in mixed feed industry.

CHAPTER 4

RECOMMENDATIONS FOR THE RANGE OF PRODUCTION OF BY-PRODUCTS

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4.01. General remarks

4.02. Basic recommendations concerning use of by-products for human consumption

4.03. Basic recommendations concerning use of by-products for industrial purposes

4.01. General remarks

The range of by-products which are to be evaluated is defined under item 3.03. of the present study.
Based on internationally common processing patterns a difference has to be made between use for human consumption and use for industrial purposes.
Under the conditions in Ethiopia use for human consumption has to be preferred at maximum height.
All other products have to be completely supplied to industrial use aiming at the most favourable type of processing viewed from economical aspects.

4.02. Basic recommendations concerning use of by-products for human consumption

Detailed recipes for the following types of use can be provided in a later stage by the consultant.
An explanation concerning physiology of nutrition of the use of the different organs can be taken from specialized literature and is not part of this report for that reason.

Kind	Types of use
liver	fresh sale, sausage production or canning
kidneys	fresh sale, sausage production or canning
spleen	sausage production or canning
heart	fresh sale, sausage production or canning
lung	sausage production or canning
throat	cleaning of meat and windpipe and supply to sausage production or canning
stomachs	cleaning, scalding of paunch for fresh sale and sausage production or canning
head with brain	splitting of the head, removal of brain, and use for sausage production or canning, fresh winning of head meat or by boiling, and addition to sausage production or canning
tongue	fresh sale, sausage production or canning
spinal marrow	animal body has to be split in the middle, removal of spinal marrow and use for sausage production or canning
tallow	fresh sale or sale after melting
blood	During killing blood has to be collected, a part may directly be added to sausage production and canning. Another part has to be processed to blood plasm with centrifuges and added to sausage production and canning as protein raw material in boiling sausage production. This raises water-absorbing capacity, stability of sausage filling, and total yield of finished products. It has a positive influence on quality.

4.03. Basic recommendations concerning use of by-products for industrial purposes

Kind	Type of use
condemned organs	Condemned slaughter caused by veterinary hygiene has to be processed to animal body meal
windpipe without meat	use for fresh dog food or animal body meal
Stomachs without paunch	processing to animal body meal
head with jaw	The cleaned meatless head has to be crushed and supplied to bone meal production. Another use is gelatin winning.
mask with mouth	Cleaning and processing to animal body meal or further treatment in tanneries
glands	Because pharmaceutical industry for the use of glands does not exist at home glands have to be provided for exportation.
tails and ear ends	Hair has to be used for brush fabrication. Possibly treatment as handicraft products.
horn material	Full horn has to be separated from the head bone or lower leg by scalding, the latter may be used for bone meal and gelatin production. Horn material has to be sawn and thermally disintegrated by separate boiling in the autoclave with addition of tallow. Tallow has to be extracted by centrifuging, horn has to be grinded and supplied to fertilizer production.
lower legs	Have to be used for bone meal production, fat has to be supplied to soap industry.
confiscates	like condemned organs for animal body meal processing and feed and fertilizer production
tallow	Tallow obtained during the autoclave process has to be cleaned in the purification basin and supplied to soap industry.

Kind	Types of use
blood for fodder	Seeping blood from slaughtering and thick blood from the centrifugation process of plasm production have to be thermally denaturated and used for blood meal production which may be utilized as high-quality feedstuff.
intestines	After correct cleaning and storage intestines are a high-quality raw material for sausage production in the own industrial sector or for exportation. They have to be won in separate kinds and sorts. Imports of foreign artificial sausage skins have to be replaced by the use of intestines. Bladders obtained during intestine winning have to be blown up by means of compressed air, tied off, and dried. They can be processed as a whole, in particular as sausage skins for cooked sausage. Furthermore it is possible to cut and sew dried bladders, and to use them as sausage skins for boiling sausages and salami. Since at present the yield is considerably higher as domestic requirements for sausage production exportation of salted intestines is recommended.
hides	Obtained skins and hides have to be won from the animals without cuts. Mechanized skinning is the optimum method. Hides have to be salted or air-dried and supplied to leather industry at home or abroad.
contents of stomachs and intestines	These contents may be used in animal feeding, but this method is not without any problems under tropical conditions. For that reason contents have to be composted on dump grounds and afterwards used as manure.
bones	Bones obtained during the slaughtering and cutting-up processes can be partially sold as fresh and sawn products or supplied to bone meal production after comminution or crushing.

CHAPTER 5

VISITED SLAUGHTERHOUSES

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5.01. General explanation

Chapter 5 gives a survey of the visited slaughterhouses and a detailed description of the present situation inside the latter.

In the interest of complexity of approach the description of the different plants comprises not only a representation of slaughtering technology and methods of by-product winning practised at present, but also advices to improve slaughtering technology in favour of maximum by-product winning for human consumption and industrial processing.

Furthermore this chapter evaluates each object viewed from aspects of economic evaluation concerning improved use of by-products.

These individual assessments form the basis for reflections related to national economy (chapter 9).

Based on check lists all visited plants were analyzed in detail and analogously.

At the same time these check lists are the basis of discussions with responsible managers of the slaughterhouses and by-product processing plants.

Evaluation related to economic evaluation of the different objects was made to an uniform pattern on the basis of inquiries, analyses of various documents, and in coordination with the Ethiopian counterpart.

Prices for buildings and structural works were fixed on the basis that all civil works are assigned to local firms.

The Ethiopian partner has provided the following binding civil prices:

- production space	1,200.- birr/m^2
- offices	400.- birr/m^2
- roads, paths	70.- birr/m^2

Prices for technical equipment and services are indicated in local currency, if they can be supplied or done through the home offer.

Prices for technical equipment which has to be covered by imports are calculated on the basis of US $ and converted into birr at the rate of US $ 1.00 = birr 2.05.
The following assumptions have to be made for reasons of lacking information about formation and development of costs.

As direct technological costs were taken:

- raw material
- utilities
- wages, salaries
- depreciation
- service (maintenance, attendance, repair)

Prices for direct technological costs were given by the Ethiopian partner (see annex 3).
Costs for distribution and sale of fabricated by-products could not be considered in the calculation of direct technological costs because the system of distribution and sale could not be exactly recorded at the moment of investigation.
In the course of feasibility studies which must be elaborated later these cost components have to be analysed and determined exactly.
Fixing of the amount of depreciation as prescribed by Ethiopian regulations was based on a normative service life of 20 years for buildings and structural works, and 10 years for technical equipment.
Service costs were calculated at 12 % of the gross value of technical equipment.
Calculation of the expenditure of additives amounts to 1 % of direct technological costs.
For management and administration 10 % direct technological costs were calculated.
Prices for slaughterhouse by-products for human consumption and industrial use are calculated in coordination with the Ethiopian partner (see annex 3) and form the basis of the calculation of economic evaluation.
For human nutrition it was considerd to stimulate the Ethiopian population to direct consumption of these by-products. For that reason this price is below the meat price of 5.- birr/kg.

If direct consumption will not be accepted, by-products suitable for human consumption have to be used for sausage production. In this case the price has to be adapted to the local sausage price. This would still increase the enterprise's financial results.

In modification suggestions for slaughterhouses and by-product processing plants only extra costs, receipts, and profits are indicated.

Duration of rate of return in years of single capital expenditure was determined on the basis of the following formula:

$$R = \frac{\text{single capital expenditure (birr)}}{\text{acquired extra profit (birr)}}$$

Net profit was determined by subtraction of funds payment of 20 % from the profits (in coordination with the Ethiopian partner).

For plants consisting of slaughterhouse and by-product processing plant only one economic evaluation was made because there is no separate registration of costs and receipts in internal accountancy as stated by the Ethiopian partner.

5.02. ADDIS ABABA - City Slaughterhouse

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5.02.-01 Review of by-products / cattle
5.02.-02 Review of by-products / sheep and goat

5.02.01. General description

The slaughterhouse was built outside the capital about 30 years ago. Meanwhile it is situated directly in the city caused by expansion of the town. For that reason the building cannot be extended.
This enterprise is not managed by the LIMCOR, but by the municipal authorities of Addis Ababa.
Mainly cattle and sheep, and a low percentage of pigs which are first of all reserved for consumers with European eating habits as well as for hotels and restaurants are slaughtered there.
Slaughtering capacity amounts to:

100,000 cattle/a for the private sector,
50,000 cattle/a for the State sector (for Meat Concentrate Factory),
58,000 sheep and goats per year, exclusively for the private sector, and
4,100 pigs/a.

The enterprise disposes of a processing plant for obtained by-products.
All slaughters are carried out exclusively in one-shift operation, mostly at night.
At present a study is elaborated to set up a new slaughterhouse on another site which has to be determined.

5.02.02. Store animal supply cattle and sheep

Animals for slaughter are supplied from a livestock market situated in the neighbourhood. About 66 % of all slaughterings are ordered by private butchers, the rest, as slaughters for state-owned enterprises.
There is no recreation for animals for slaughter.

5.02.03. Slaughter pig / cattle / sheep

Pig slaughtering is only by State order for consumers with European eating habits.
The statistic average of slaughters is only 15 head/day which results in an only insignificant proportion of by-products within the overall balance being in the tolerance limits of this study, anyhow.
Even winning of pig hide (crop) would require an extremely high expenditure of equipment. Cost occuring from this would be untenable high. In consideration of this fact these slaughters are no longer investigated, the more so as there were no pig slaughters on both days of visit.
Slaughtering plants for cattle and sheep show an extremely low degree of mechanization. Slaughtering is at one place and only to a minor extend at a conveyor line.
Carcasses are marked with the number of the respective owner or butcher and freshly returned to the customer immediately after slaughtering.
For State customers carcasses are deboned in a separate room.
There are three slaughtering technologies for cattle and sheep: for Muslim, European, and home slaughters.

5.02.04. Kind, quantity, and quality of by-products / cattle

The major part of by-products is won and processed by the slaughterhouse.
Certain by-products such as

heads,
lower legs,
fats

are bought and processed by the customer.
Table 5.02.-01 comprises a survey of kinds and quantities.
The total quantity of obtained by-products amounts to altogether 27,298.0 t (including bones from cutting-up).
In case of full utilization of all by-products with regard to the actual conditions in animal keeping, animal hygiene, etc the following quantities could be used:

for human consumption:	3,345.0 t
for industrial use:	23, 953.0 t

Actually only the following quantities are used:

for human consumption:	2,388.0 t
for industrial use:	14,625.0 t

The remaining 10,275 t are not used, but mostly thrown on a dumping ground (hard skull and jaw bones, as well as horns and manure).
Altogether it must be stated that the quality of by-products comes up to the purpose of processing to animal body meal.
Further detailed evaluations under the items below.

5.02.05. Kind, quantity, and quality of used by-products and possibilities of quality increase / cattle

Table 5.02.-01 shows kinds and quantities of by-products.
For quality description:

Liver: Quality of winning meets requirements, a high percentage is infected with pathogens and has to be condemned. Condemned slaughter of about 60 % being supplied to animal body meal production.

Kidneys: Quality of winning comes up to the standard, about 60 % condemned slaughter being supplied to animal meal production.

Heart: Quality of winning comes up to the standard, about 20 % condemned slaughter being supplied to animal body meal production.

Tongue: Won together with head meat, about 15 % condemned slaughter, is not separated and is returned to the customer.

Paunch: Is won in good quality, emptied, and washed, is returned unscalded to the customer.

Ears, mouth, and masks: Are separated from the head as prescibed and supplied to by-product processing plant.

Spinal marrow: Is supplied to animal body meal production together with spine bones, no separation.

Glands: Are not separated during the slaughtering process, use for animal body meal production together with intestines. Quality of winning would allow pharmaceutical processing.

Tails: Hair is separated as prescribed, classified, and supplied to an enterprise outside the factory.

Horn: Is separated from the head and supplied to animal body meal production, quality comes up to the standard.

Lower legs: Are supplied to the by-product processing plant, without pretreatment.

Confiscates: Are immediately supplied to animal body meal production during the slaughtering process.

Tallow: Is won during the slaughtering process, in most cases very contaminated, can only be supplied to animal body meal production.

Blood: Is supplied to blood meal production through an open channel system, is very contaminated by excrements and paunch contents.

Intestines: Supplied together to animal body meal production, quality would allow processing to sausage skins.

Hides: Are won from lying carcasses, often showing cuts, are treated subsequently and trimmed.

5.02.06. Kind, quantity, and quality of by-products not used at present / cattle

Specifications of kind and quantity are shown in table 5.02.-01.
For quality determination:

Spleen:	Quality would allow processing for human consumption, but is used as dog food by the customer.
Lung with throat:	Quality would allow processing for human consumption, but is used as dog food by the customer.
Heads with brain:	The head is not supplied to the by-product processing plant, but directly thrown on a dump situated on the enterprise's grounds, for that reason brain remains unused as well.
Gallbladder:	Remains on the liver after slaughtering and is returned to the customer.
Contents of stomachs and intestines:	Are washed away with water, preparation for agricultural use would be possible.

5.02.07. By-products treated in processing plants

By-products which are actually processed in industry are also shown in table No 5.02.-01. The total quantity of by-products used in industry listed in the table is mostly supplied to meat and bone meal production.

5.02.08. Kind, quantity, and quality of by-products sheep / goats

Table No 5.02.-02 comprises a survey of kinds and quantities. The quantity of obtained products totals 995.1 t per year at present.

In case of full utilization of all by-products and with regard to the present conditions in animal keeping, animal hygiene, etc the following quantities could be used per year:

for human consumption	165.0 t
for industrial use	830.0 t

Actually only the following quantities are used:

for human consumption	107.0 t
for industrial use	635.0 t.

The residual 253 t are not used. The applied slaughtering technology allows all-round winning of by-products with slight modification.

The quantity of by-products obtained for industrial use is relatively high because of the elevated percentage of condemned organs.

5.02.09. Kind, quantity, and quality of used by-products and possibilities of quality increase

The quantity of used by-products has to be taken from table 5.02.-02.

For quality determination:

Liver: Quality of winning comes up to the standard, condemned slaughter rate of 50 %.

Kidneys: Quality of winning comes up to the standard, condemned slaughter rate of 10 %.

Heart: Quality of winning comes up to the standard, condemned slaughter rate of 20 %.

Tongue: Would come up to the standard after separation from the head.

Paunch: Is won in good quality, emptied, washed, and returned to the customer.

Glands: Are not separated during the slaughtering process, used for animal body meal production together with intestines. Quality would allow pharmaceutical processing.

Lower legs: Are supplied to the by-product processing plant without pretreatment.

Confiscates: Are supplied to animal body meal production during the slaughtering process.

Blood: Is supplied to blood meal production through an open channel system, is very contaminated by excrements and saliva.

Intestines: Are supplied together to animal body meal production, quality would allow processing to sausage skins.

Hides: Quality of winning comes up to the standard.

5.02.10. Kind, quantity, and quality of by-products not used at present

Kind and quantity specifications are shown in table No 5.02.-02.
For quality determination:

Spleen:	Quality would allow processing for human consumption, but is used as dog food by the customer.
Lung with throat:	Quality would allow processing for human consumption, but is used as dog food by the customer.
Heads with brain:	The head is not supplied to the by-product processing plant, but thrown on the bone dump. For that reason also the brain remains unused.
Stomach contents:	Are washed away with water. Preparation for agricultural use would be possible.

5.02.11. By-products treated in processing plants

By-products which are actually processed in industry are shown in table No 5.02.-02.
The total quantity of the listed by-products is mostly supplied to meat and bone meal production. They are added to by-products from cattle slaughtering.

5.02.12. Modification of slaughterhouse operations in favour of maximum by-product winning

To make all-round use of the outstanding items in tables 5.02.-01/02 the following operations have to be introduced:

This refers to by-products which can already be favourably processed as well.

Blood: When bleeding the animal body, a distinctions has to be made between blood during killing and seeping blood. For this purpose animals have to be drawn up with the existing lift after stunning. A blood vessel has to be put under the carcass. Only then bleeding can be started. Blood has to be mixed with anticoagulums or stirred. The use of chemicals is preferable. From the obtained blood from killing plasm can be won by centrifugation. Seeping blood has to be processed as before.

Brain: The obtained head has to be split with a cleaver, and the brain has to be removed. Brain may be consumed as fresh product or processed in sausages.

Glands: Operations of gland winning have immediately to be introduced, if appropriate sales possibilities exist at home and abroad. Work places for these operations are available.

Intestines: Intestines should no longer be supplied to the animal body meal department. Instead of this intestines have to be separated after slaughtering, deslimed, and salted. These operations are new and have to be introduced for increase of gain and replacement of artificial sausage skin imports.

Spleen: Spleen used up to now for feeding purposes has to be supplied to sausage production.

Stomach contents:	Have no longer to be washed away with sewage water, but collected, composted on dump grounds, and supplied to agricultural use.
Lung:	The usable part of lungs has to be separated from windpipe and troat, and supplied to sausage production.
Spinal marrow:	The spine has to be split in the middle, the spinal marrow has to be removed and used for sausage production.

5.02.13. Economic evaluation

Investments

To put the modification suggestions into practice as described under item 5.02.12. the following investments are necessary:

	local currency	foreign currency
a) Structural works		
-	-	-
b) Technical equipment		
- use of contents of stomachs and intestines		
. 2 trailers for manure	-	10,000.-
- for blood plasm winning		
. 1 centrifuge	-	12,000.-
. 1 storage tank 0.5 m³	500.-	-
. 2 storage tanks 2.0 m³ mobile	3,200.-	-
- for gland storage		
. 1 cold storage cell 4 t	-	20,000.-
. 10 plastic barrels at 100 l each	1,000.-	-
	4,700.-	42,000.-
Total	46,700.-	

Labour

Supervisor	1 worker
for intestine winning:	30 workers
for gland winning:	6 workers
for blood plasm winning:	2 workers
for lung winning:	1 worker
for winning of contents of stomachs and intestines:	2 workers
	42 workers

Additional currents costs

wages		28,200.- birr/a
maintenance, attendance, repair	12 %	5,600.- birr/a
depreciation	10 %	4,700.- birr/a
		38,500.- birr/a

Extra receipts

blood plasm	160.0 t	56,000.- birr/a
glands	87.5 t	437,500.- birr/a
intestines	5,650,000 m	565,000.- birr/a
organs for direct human consumption as indicated in tables 5.02.-01 and 5.02.-02	688.0 t	1,376,000.- birr/a
	about	2,434,500.- birr/a

Cost-benefit-analysis

receipts:	2,434,500.- birr/a
costs:	38,500.- birr/a
proceeds:	2,396,000.- birr/a

profit: proceeds - funds payment (20 %)

2,396,000.- - 479,200.- = 1,916,800.- birr/a

rate of return: $\frac{46,700.- \text{ birr}}{1,916,800.- \text{ birr/a}}$ = 0.02 years

Table No 5.02.-01:

Review of by-products - ADDIS ABABA - City Slaughterhouse

Animal: cattle

Kind of by-product	By-product per head kg	By-products per year t	By-product for human consumption used t/a	unused t/a	By-product for ind. purposes used t/a	unused t/a
Liver	4.7	705	423	-	282	-
Kidneys	1.3	195	117	-	78	-
Spleen	1.1	165	-	165	-	-
Heart	1.4	210	168	-	42	-
Lung Throat	5.2	780	-	432	288	-
Paunch Rumen Stomach	15.2	2,280	1,500	-	780	-
Head	10.3	1,545	-	-	-	1,545
Tongue	1.4	210	180	-	30	-
Brain	0.3	45	-	45	-	45
Mouth Mask	3.2	480	-	-	480	-
Udder	-	-	-	-	-	-
Spinal Marrow	0.1	15	-	15	15	-
Pancreas	0.2	30	-	-	30	-
Suprarenal body	0.05	7.5	-	-	7.5	-
Gall	0.3	45	-	-	-	45
Gallbladder peel	0.02	3.0	-	-	-	3
Ear Ends	0.05	7.5	-	-	7.5	-
Tail	0.1	15	-	-	15	-
Horn	0.5	75	-	-	50	25
Legs	6.0	900	-	-	900	-
Confiscate	8.5	1,275	-	-	1,275	-
Tallow	11.0	1,650	-	-	1,650	-
Fodder blood	13.0	1,950	-	-	1,950	-

Table No 5.02.-01:

Review of by-products - ADDIS ABABA - City Slaughterhouse

Animal: cattle

Kind of by-products	By-product per head kg	By-products per year t	By-product for human consumption used t/a	unused t/a	By-product for ind. purposes used t/a	unused t/a
Processing blood	2.0	300	-	300	300	-
Intestines						
- small	3.5	525	-	-	525	-
- medium	2.5	375	-	-	375	-
- large	1.0	150	-	-	150	-
- bladders	0.1	15	-	-	15	-
- fat ends	0.6	90	-	-	90	-
Skin	22.0	3,300	-	-	3,300	-
Contents of Stomachs and intestines	41.1	6,165	-	-	2,000	4,165
Bones from deboning sector		3,790	-	-	-	3,790
Total		27,298.0	2,388.0	957.0	14,635.0	9,618.0

Table No 5.02.-02:

Review of by-products - ADDIS ABABA - City Slaughterhouse

Animal: sheep and goats

Kind of by-product	By-product per head kg	By-product per year t	By-product for human consumption used t/a	unused t/a	By-product for ind. purposes used t/a	unused t/a
Liver	0.5	28.9	14.4	-	14.5	-
Kidneys	0.1	5.8	5.2	-	0.6	-
Spleen	0.1	5.8	-	5.8	-	-
Heart	0.1	5.8	4.6	-	1.2	-
Lung Throat	0.6	34.7	-	20.8	13.9	-
Paunch Rumen Stomach	2.0	110.0	80.0	-	-	30
Head	1.6	92.3	-	-	-	92.3
Tongue	0.1	5.8	2.9	-	-	2.9
Brain	0.1	5.8	-	5.8	-	-
Mask	-	-	-	-	-	-
Udder	0.1	5.8	-	5.8	-	-
Glands / Pancreas	0.035	2.0	-	-	2.0	-
Horn	0.04	2.3	-	-	-	2.3
Confiscate	1.95	112.5	-	-	112.5	-
Suet	-	-	-	-	-	-
Fodder blood	1.7	98.1	-	-	98.1	-
Processing blood	0.3	17.3	-	17.3	17.3	-
Plasm	-	-	-	-	-	-
paunch contents	1.5	86.5	-	-	-	86.5
Fine intestines Blind gut	3.5	201.9	-	-	201.9	-
Lower legs	0.5	28.9	-	-	28.9	-
Skin	2.5	144.3	-	-	144.3	-
Total		995.1	107.1	55.5	635.2	214.0

5.03. ADDIS ABABA - Satellite Slaughterhouse

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5.03.02. Store animal supply

5.03.03. Slaughter

5.03.04. Kind, quantity, and quality of by-products

5.03.05. Kind, quantity, and quality of used by-products

5.03.06. Kind, quantity, and quality of by-products not used at present

5.03.07. By-products treated in processing plants

5.03.08. Modification of slaughterhouse operations in favour of maximum by-product winning

5.03.09. Economic evaluation

Table:

5.03.-01 Review of by-products

5.03.01. General description

The essential part of meat for the capital Addis Ababa is supplied by the satellite slaughterhouses. A network of these slaughterhouse types which are situated about 10 to 20 km from each other is spread over the whole city area. On the outskirts of the town the density of these slaughterhouses becomes looser and looser.

About 20 slaughterhouses are available for private trade in the city centre. They do only service slaughtering.

Organizational management of these slaughterhouses is by a butchers' cooperative. As stated by the partner 30 cattle are daily supplied to slaughter on an average per slaughterhouse. Slaughtering is mainly during the night shift. Obtained products are delivered to the private butchers without refrigeration early in the morning.

The buildings of the slaughterhouses differ only negligibly from each other and are in a very bad state.

Electric and water supply are insufficient. There is no refrigerating possibility in any of the enterprises. By-product processing is not possible. Special pits were dug for condemned organs, bones, and blood, into which these remainders are thrown. If the level is reached, the pits are closed, and new ones are dug.

In the neighbourhood of these enterprises parasites and carrion feeders are very often to be found.

Obtained sewage water is let off into adjoining brooks without previous treatment. Direct transporting-away of by-products by trucks or containers is hardly for reasons of insufficient connections to the main traffic network.

5.03.02. Store animal supply

Animal supply is by hoof from local livestock markets. Only bulls and oxen are brought to slaughter. Animals are marked by the respective customer. There is no veterinary-hygienic live examination.

5.03.03. Slaughter

The slaughtering process is carried out as nest work, mostly on the floor of the slaughterhall. Technical devices for the slaughtering process do not exist.
Technological possibilities inside the building and technological conditions do not allow hygienically perfect winning and processing of slaughtering by-products.
Because of cramped conditions fresh-slaughtered carcasses must be immediately transported to the customer.

5.03.04. Kind, quantity, and quality of by-products

Calculation of all obtained by-products is based on the fact that about 20 enterprises of the same size and capacity exist in the city area of Addis Ababa. In principle parameters of these enterprises do not differ from each other.
For that reason overall table No 5.03.-01 was elaborated and assessed for all satellite slaughterhouses.
Yield of by-products totals 24,760 t.
From this quantity could be used

for human consumption	4,031	t
and for industrial use	20,729	t.

At present are used

for human consumption	0	t
and for industrial use	3,476	t (hides only).

This results in a residual quantity of 21,284.0 t of unused by-products.
Quality of by-products is reduced because of the applied slaughtering technology. Evaluation was not in every case possible during the visits because the enterprises did not demonstrate the direct slaughtering process. For reason of these conditions a general view of quality can only be derived by means of table No 5.03.-01 as far as kind and quantity are concerned.

5.03.05. Kind, quantity, and quality of used by-products

By-products used at present are shown in table No 5.03.-01. At Addis Ababa it is common practice to sell offals and loose inner fats as grown. The consumer uses these products for feeding purposes. Hides are air-dried and supplied to tanneries. Quality is reduced by cuts and notches.

5.03.06. Kind, quantity, and quality of by-products not used at present

Based on the total yield less used by-products 21,284.0 t are not used at present. Under the actual conditions use for human consumption is not possible for reasons of slaughtering technology as well as hygiene. By appropriate classification and supply industrial use in a central animal body meal producing plant would be possible.

5.03.07. By-products treated in processing plants

No other by-products apart from hides.

5.03.08. Modification of slaughterhouse operations in favour of maximum by-product winning

Based on the given conditions of the course of slaughter and the existing building modification of slaughterhouse operations is not recommended because expenditure would exceed the gained profit.
It is suggested to collect all obtained condemned organs, blood, offals, and bones, and to supply them to a central processing plant against payment. All necessary containers and vessel systems have to be provided by the buyer.
On a long-term basis all satellite slaughterhouses are not tolerable for reasons of hygiene. After setting up a central slaughterhouse with a respective total capacity these enterprises have immediately to be closed.

5.03.09. Economic evaluation

For sale to the central processing plant 18,369 t/a of by-products might be provided for animal body meal production (17,253 t of by-products + 800 t of tallow + 316 t of blood).

18,369 t x 50.- birr/t = 918,450.- birr/a

of extra gain for the satellite slaughterhouses.
Fresh feed supply of organs should kept up for the time being.
An evaluation related to economic evaluation is made together with the planned central by-product processing plant at Addis Ababa.

Table No 5.03.-01:

Review of by-products - ADDIS ABABA - Satellite Slaughterhouses

Animal: cattle

Kind of by-product	By-product per head kg	By-products per year t	By-products for human consumption used t/a	By-products for human consumption unused t/a	By-products for ind. purposes used t/a	By-products for ind. purposes unused t/a
Liver	4.7	742.6	-	297.1	-	445.5
Kidneys	1.3	205.4	-	82.2	-	123.2
Spleen	1.1	173.8	-	139.0	-	34.8
Heart	1.4	221.2	-	177.0	-	44.2
Lung	4.8	758.4	-	379.2	-	379.2
Throat	0.4	63.2	-	10.0	-	53.2
Paunch Rumen Stomach	15.2	2,400.0	-	1,580.0	-	820.0
Head	10.3	1,627.4	-	-	-	1,627.4
Tongue	1.4	221.2	-	188.0	-	33.2
Brain	0.3	47.4	-	47.4	-	-
Mouth Mask	3.2	505.6	-	-	-	505.6
Spinal Marrow	0.1	15.8	-	15.8	-	-
Pancreas	0.2	31.6	-	-	-	31.6
Suprarenal body	0.05	7.9	-	-	-	7.9
Gall	0.3	47.4	-	-	-	47.4
Gall bladder peel	0.02	3.2	-	-	-	3.2
Ear ends	0.05	7.9	-	-	-	7.9
Tail	0.1	15.8	-	-	-	15.8
Horn	0.5	79.0	-	-	-	79.0
Legs	6.0	948.0	-	-	-	948.0
Confiscates	8.5	1,343.0	-	-	-	1,343.0
Tallow	11.0	1,738.0	-	800.0	-	938.0
Blood for Fodder	13.0	2,054.0	-	-	-	2,054.0
Blood for Processing	2.0	316.0	-	316.0	-	-
Plasm	-	-	-	-	-	-

Table No 5.03.-01:

Review of by-products - ADDIS ABABA - Satellite Slaughterhouses

Animal: cattle

Kind of by-product	By-product per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Intestines (m/head)						
- small						
- medium						
- large	7.7	1,216.6	-	-	-	1,216.6
- bladders						
- fat ends						
Skin	22.0	3,476.0	-	-	3,476.0	-
Contents of stomachs and intestines	41.1	6,494.0	-	-	-	6,494.0
Total		24,760.4	-	4,031.1	3,476.0	17,252.7

5.04. DEBRE ZEYT - Slaughterhouse Debre Zeyt

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Tables:

5.04.-01 Review of by-products / cattle
5.04.-02 Review of by-products / sheep

5.04.01. General description

The slaughterhouse at Debre Zeyt was built in 1973 and has a slaughtering capacity of 150 cattle / shift or 300 sheep / shift. Technical plants are in a good condition. Slaughtering technology is simple with a low degree of mechanization and is used for sheep and cattle. Slaughtering products serve to provide the 35000 inhabitants of Debre Zeyt with food, to supply the Meat Concentrate Factory at Addis Ababa and partially for exportation to Arab countries (frozen sheep). Water supply is ensured by own wells. Electric supply is provided with enough reserves at the local high-voltage system. Extension of the production buildings is possible on the existing production grounds.

5.04.02. Store animal supply sheep / cattle

Animal supply is by hoof from private animal owners or through the State Livestock Marketing Enterprise.
Before slaughtering animals are pastured for 2-3 days for recreation.

5.04.03. Slaughter sheep/cattle

There is only service slaughter for private butcher's shops and State firms.
The whole plant has a low degree of mechanization with mostly manual operations at suspension conveyors with manual transport.

5.04.04. Kind, quantity, and quality of by-products / cattle

Table No 5.04.-01 shows kinds and quantities. The quantity of obtained by-products totaled 4,820.3 t for the business year 85/86.
Taking the present conditions in livestock keeping into account (animal diseases), the following quantities could be used:

- for human consumption 251.6 t
- for industrial use 4568.7 t

Actually only the following quantities are used:

- for human consumption 0.0 t (as stated by the partner)
- for industrial use 422.4 t (only hides).

The quality of by-products does not only depend on the technology applied in the enterprise of Debre Zeyt, but first of all on the conditions of the animal producers.
Losses of by-products for human consumption are particularly great because of the unusually high percentage of condemned slaughter being above the European average.
The applied slaughtering technology meets the requirement made on quality winning of by-products basically.

5.04.05. Kind, quantity, and quality of used by-products, possibilities of quality increase / cattle

The only by-products being used are hides which are delivered to the tanneries immediately after slaughter and prepared for the local, and the export market as well.
Hides show a high percentage of slaughtering damages.
Mechanized skinning would essentially improve hide quality and thereby increase the range of use.

5.04.06. Kind, quantity, and quality of by-products not used at present / cattle

Kind and quantity are shown in table 5.04.-01.
The quality of by-products, which are not used, is the following:

Liver: Quality of winning meets requirements, high infestation with parasites (condemned slaughter rate of about 40 %), remaining 60 % are delivered to the animal supplier (state-owned and private) who sells them exclusively for feeding purposes.

Kidneys: Quality of winning meets requirements, condemned slaughter caused by diseases of about 40 %, residual quantity also only used for animal feeding.

Spleen: Quality of winning meets requirements, hardly any condemned slaughter, use as animal food.

Heart: Quality of winning meets requirements, condemned slaughter rate 20 %, animal food 80 %.

Lung with throat: Quality of winning meets requirements, condemned slaughter rate 40 %, animal food 60 %, throat meat has to be won, cleaned, and added to deboned meat.

Paunch, stomach: Quality of winning meets requirements, hardly any condemned slaughter, used as animal food.

Heads with tongue and brain: Not separated, with whole horn, hardly any condemned slaughter, returned to animal supplier.

Hooks: Quality of winning without faults, returned to owner for individual use.

Udder: Not won separately, returned to p[illegible]er, hardly any condemned slaughter, animal fo[illegible].

Spinal marrow: Not won separately, remains in the bone.

Glands altogether: Not cut off, quality could be usable.

Ear ends and tails: Quality would allow processing, have to be collected separately.

Horn material: Could be used for horn meal after scalding process, for winning separation from head and lower legs necessary.

Lower leg: Quality winning allows processing.

Confiscates: Quality winning allows processing.

Tallow: Quality is reduced by contamination, at present dog food.

Blood: Quality allows processing.

Intestines: Quality allows processing to sausage skins.

Contents of stomachs and intestines: Could be processed or composted.

5.04.07. By-products treated in processing plants / cattle

At present hides are the only by-products which are won. Hides obtained by service slaughter are returned to the respective supplier who passes them to tanneries.
In case of service slaughter for the State sector hides are air-dried in the slaughterhouse and directly delivered to the tanneries.

5.04.08. Modification of slaughterhouse operations in favour of maximum by-product winning / cattle

At present the by-products listed in table 5.04.-01 could be used. The following operations are necessary and have to be introduced in order to carry out these processes:

Blood: As prescribed by the applied technology blood has to be collected in separate vessels and stirred to prevent coagulation. In this connection a distinction has to be made between blood from killing and seeping blood and, depending on requirements, plasm. blood have to be won for human consumption, and blood, for blood meal production.

Liver: The condemned slaughter proportion of 40 % has to be supplied to processing for animal body meal. The proportion of 60 %, which is not used for human consumption up to now, has to be supplied to processing as sausage products or prepared for exportation.

Kidney: Like liver processing to sausage, export possibilities have to be found.

Spleen: Like liver processing to sausage, export possibilities have to be found.

Heart: Processing to sausage, possibly exportation.

Lung: Processing sausage, export possibilities have to be found, throat and not usable part have to be supplied to animal body meal production.

Paunch and stomachs: Paunch has to be cleaned with hot water and scalded to make these parts usable for human consumption. Unsaleable parts are to be used for animal body meal production.

Heads with tongue and brain: Meat parts, tongue, muscle meat, and brain have to be separated in the slaughterhouse and supplied to the customer. Bones and horn material have to be provided for meal production.

Mask with mouth: Have to be returned to customer for individual use or bought from the latter for meal production.

Udder: Has to be separated from skin and supplied to meal production. Use as foodstuff for sausages in possible.

Spinal marrow: The animal body has to be split in the middle to remove the spinal marrow from the spinal canal. After this the spinal marrow is supplied to the desired processing (use in sausage production possible).

Glands and other pharmaceutic parts: All obtained glands have to be won and stored as required by their purpose. When winning the gallbladder, stones have to be separated. In this connection and also for glands own processing and export possibilities have to be used.

Ear ends and tails: Have to be collected in the slaughterhouse, salted, and supplied to local processing.

Horn material: Has to be separated from lower legs and head and supplied to horn meal production.

Lower legs: Have to be supplied to bone and meat meal production.

Confiscates: Have to be supplied to animal body meal production.

Tallow: Animal body tallow may also be heat-treated and used in food industry.

Intestines: The intestines have to be separated. Fine intestines, blind gut, and fat ends have to be won for sausage production, salted, and put in intermediate storage. The unusable part and the residual intestines have to be used for animal body meal winning.

Contents of stomachs and intestines: Have to be collected, composted at appropriate deposit places, and later supplied to agricultural purposes.

5.04.09. Kind, quantity, and quality of by-products / sheep

Table No 5.04.-02 shows a review.
The quantity of obtained by-products totaled to 243.1 t for the business year 85/86 (June, 85 - May, 86).
In case of full use of all by-products and with regard to the actual conditions (livestock keeping, animal hygiene, transport, etc.) the following quantities could be used:

- for human consumption 27.4 t,
- for industrial use 215.7 t.

In fact only the following quantities are used:

- for human consumption 4.8 t,
- for industrial use 38.9 t.

The residual 199.4 t are not used.
The quality of by-products does not only depend on the technology applied in the enterprise of Debre Zeyt, but first of all on the conditions of the animal producers and suppliers. Losses of by-products for human consumption are particularly great because of the unusually high percentage of condemned slaughter being above the European average.
The applied slaughtering technology meets the requirements made on quality winning of by-products basically.

5.04.10. Kind, quantity, and quality of used by-products, possibilities of quality increase / sheep

Liver: Quality of winning meets requirements. A high percentage is infected by pathogens and has to be condemned (altogether 50 % condemned slaughter).

Kidney: Quality of winning comes up to the standard (10 % condemned slaughter).

Heart: Quality of winning comes up to the standard (20 % condemned slaughter)

Tongue: Quality of winning comes up to the standard (no condemned slaughter), tongue remains at the removed low jaw.

Skin: Skinning is by hand. Hide quality is reduced by knife cuts. For that reason use of mechanized skinning is recommended.

Testicles: Are won in good quality for exportation to the Arabian region. Export rate should be increased to 100 %, previous percentage 50 %, no condemned slaughter caused by quality.

5.04.11. Kind, quantity, and quality of by-products not used at present / sheep

Kind and quantity of by-products, which are not used, are shown in table 5.04.-02.
The quality of unused by-products can be assessed as follows:

Lung: Is won as required during the slaughtering process. Condemned slaughter amounts to 40 % caused by diseases and killing by throat cut.
Condemned slaughter could essentially be reduced by stunning before killing. Actually an unknown proportion of lung is sold as dog food.
Lung has to be utilized for human consumption and supplied to sausage producing enterprises for this purpose.

Throat: Is won in a quality coming up to the use as dog food or confiscates. In future throat has to be won for human consumption in order to add it to deboned meat (50 g/animal).

Stomach: Are won uncleaned as confiscates. There is no winning and drying of the fourth stomach for cneese industry. This type of use should be recommended.

Head: Skin remains at the head bone, brain is not removed. (Parts have to be separated).

Brain: See head, has to be used for human consumption.

Mask: See head, has to be supplied to the animal body meal department.

Udder: Quality meets requirements, actually not used for human consumption.

Condemned organs: Suited for animal body meal production.

Pancreas: Quality meets requirements, has to be separated.

Horn material: Remains on head and feet.

Suet: Quality meets requirements, remains at intestines and carcass.

Blood: Highly contaminated by technology.

Intestines: Remain together, meet requirements (no holes).

Spleen: Meets requirements, remains at the intestines.

5.04.12. By-products treated in processing plants / sheep

At present hides are the only by-products which are salted in a shed or air-dried, and supplied to tanneries.
The part of the hides obtained by service slaughter is returned to the respective owner and processed.

5.04.13. Modification of slaughterhouse operations in favour of maximum by-product winning / sheep

At present the by-products listed in table 5.04.-02 could be used.
To carry out these processes the following operations are necessary and have to be introduced:

Blood: Has to be collected, for this purpose animals have to be hanged on a suspension conveyor and bled into a vessel. After this blood has to be preserved.

Brain: The head has to be split with a cleaver, the brain has to be removed and transported to cold-storage.

Udder: Has to be separated and transported to cold-storage.

Lung: Has to be separated from intestines and transported to cold-storage.

Testicles: Have to be separated, packed, and freeze-stored for exportation.

Throat: Has to be separated from the windpipe and added to deboned meat.

5.04.14. Total yield of by-products and recommendations for their use

Altogether the following quantities of by-products may be used on the basis of the 85/86 production structure:

- for human consumption	279.0 t/a	comprising 27.4 t of sheep and 251.6 t of cattle
- for industrial use	4,808.0 t/a	comprising 239.0 t of sheep and 4,569.0 t of cattle of it 1,500.0 t from purchasing

To utilize by-products of industrial purposes setting-up of an appropriate processing capacity on the slaughterhouse grounds is recommended. The plant's capacity should amount to 1 t/h and run in three shifts. Thereby about 1000 t of bone and meat meal could be produced per year.
A detailed description of this processing plant follows in chapter 10 of this study.

Based on the types of use by-products for human consumption described in chapter 3, altogether 279.0 t of by-products could be won per year by modification of slaughterhouse operations. Modification suggestions have already been described under item 5.04.08. and 5.04.13.

5.04.15. Economic evaluation

Investments

To put the modification suggestions into practice as described under item 5.04.08. and 5.04.13. the following investments are necessary:

	local currency	foreign currency
	birr	birr
a) Structural works		
- for blood winning	1000.-	-
1 pit 2.0 x 2.0 x 2.0 m		
- for skinning		
1 foundation for skinning apparates	1000.-	-
- other works		
diverse mortising and lodging works	3000.-	-
	5000.-	
	birr	birr
b) Technical equipment		
- for blood utilization:		
1 centrifuge	-	12,000.-
1 container 1.0 m^3 for blood	3000.-	-
1 container 0.5 m^3 for plasm	3000.-	-
1 sump pump 2 m^3/h	-	1,500.-
1 pipe system	4500.-	-
- for intestine and gland winning:		
5 tables	2500.-	-
5 connections to the existing hot water system	2500.-	-

		birr	birr
- for skinning			
1 skinning apparatus		-	10,000.-
		15,500.-	23,500.-
		23,500.-	
	Total	39,000.-	

Labour

for blood winning/utilization:		not additional workers
for intestine and gland winning:		5 workers
for skinning:		2 workers
	plus	3 workers

Additional current costs

wages	3 workers	2,000.- birr/a
maintenance, attendance, repair		1,000.- birr/a
depreciation 10 % of 44,000.- birr		4,400.- birr/a
		7,400.- birr/a

Extra receipts

glands	10 t	50,000.- birr/a
intestines	600,000 m	60,000.- birr/a
blood plasm	25 t	8,750.- birr/a
organs for direct human consumption indicated in tables No 5.04.-01 and 5.04.-02	275 t	550,000.- birr/a
		668,750.- birr/a

Cost-benefit-analysis

receipts:	668,750.- birr/a
costs:	7,400.- birr/a
	676,150.- birr/a
proceeds:	

profit:	proceeds	-	funds payment (20 %)	
	676,150.-	-	135,230.-	= 540,920.- birr/a

rate of return:

$$\frac{\text{investments}}{\text{profit}} = \frac{39{,}000.-}{540{,}920.-} = 0.08 \text{ years}$$

Table No 5.04.-01

Review of by-products - Slaughterhouse Debre Zeyt

Animal: cattle

Kind of by-product	By-product per head kg	By-product per year t	By-product for human consumption used t/a	By-product for human consumption unused t/a	By-product for ind. purposes used t/a	By-product for ind. purposes unused t/a
Liver	4.7	90.2	-	54.1	-	36.1
Kidneys	1.3	24.9	-	15.0	-	9.9
Spleen	1.1	21.1	-	21.1	-	-
Heart	1.4	26.9	-	21.5	-	5.4
Lung	4.8	92.2	-	55.3	-	36.9
Throat	0.4	7.7	-	-	-	7.7
Paunch Rumen Stomach	42.4	814.1	-	-	-	814.1
Head	10.3	197.8	-	-	-	197.8
Tongue	1.4	26.9	-	26.9	-	-
Brain	0.3	5.8	-	5.8	-	-
Mouth Mask	3.2	61.4	-	-	-	61.4
Udder	1.2	23.0	-	11.5	-	11.5
Spinal marrow	0.1	2.0	-	2.0	-	-
Condemned organs						
Pancreas	0.2	3.8	-	-	-	3.8
Suprarenal body	0.05	1.0	-	-	-	1.0
Gall	0.3	5.8	-	-	-	5.8
Gallbladder peel	0.02	0.4	-	-	-	0.4
Ear ends	0.05	1.0	-	-	-	1.0
Tail	0.1	1.9	-	-	-	1.9
Horn	0.5	9.6	-	-	-	9.6

Table No 5.04.-01

Review of by-products - Slaughterhouse Debre Zeyt

Animal: cattle

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	By-products for human consumption unused t/a	By-products for ind. purposes used t/a	By-products for ind. purposes unused t/a
Legs	6.0	115.2	-	-	-	115.2
Confiscate	2.5	163.2	-	-	-	163.2
Tallow	11.0	211.2	-	-	-	211.2
Fodder blood	13.0	249.6	-	-	-	249.6
Processing blood	2.0	38.4	-	38.4	-	-
Plasm	-	-	-	-	-	-
Intestines						
- small	3.5	67.2	-	-	-	67.2
- medium	2.5	48.0	-	-	-	48.0
- large	1.0	19.2	-	-	-	19.2
- bladders	0.1	1.9	-	-	-	1.9
-fat ends	0.6	11.5	-	-	-	11.5
Skin	22.0	422.4	-	-	422.4	-
Contents of stomachs and intestines	25.0	480.0	-	-	-	480.0
Bones from deboning	76.0	1,575.0	-	-	-	1,575.0
Total	-	4,820.3	-	251.6	422.4	4,146.3

Table No 5.04.-02

Review of by-products - Slaughterhouse Debre Zeyt

Animal: sheep

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Liver	0.5	7.8	1.9	2.0	-	3.9
Kidneys	0.1	1.6	0.7	0.7	-	0.2
Spleen	-	-	-	-	-	-
Heart	0.1	1.6	0.6	0.6	-	0.4
Lung	0.4	6.2	-	3.7	-	2.5
Throat	0.1	1.6	-	-	-	1.6
Paunch Rumen Stomach	2.0	31.1	-	-	-	31.1
Head	1.6	24.9	-	-	-	24.9
Tongue	0.1	1.6	1.6	-	-	-
Brain	0.1	1.6	-	1.6	-	-
Mask	0.6	9.3	-	-	-	9.3
Udder	0.1	1.6	-	1.6	-	-
Condemned organs						
Glands / Pancreas	0.035	0.5	-	-	-	0.5
Horn	0.04	0.6	-	-	-	0.6
Confiscate	1.35	20.9	-	-	-	20.9
Fodder blood	1.2	18.7	-	-	-	18.7
Processing blood	0.8	12.4	-	12.4	-	-
Plasm	-	-	-		-	-
Fine intestines and blind gut	3.5	54.4	-		-	54.4
Skin	2.5	38.9	-	-	38.9	-
Lower legs	0.5	7.8	-	-	-	7.8
al	-	243.1	4.8		38.9	176.8

5.05. MALGE WONDO - ELIDCO Meat Factory (Slaughterhouse)

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Table:

5.05.-01 Review of by-products

5.05.01. General description

The ELIDCO Meat Factory comprises a slaughterhouse with a capacity of 250 to 300 cattle or 600 sheep per shift, an industrial by-product processing plant, and a tinnery.
Both of the plants are used to make products for exportation and for the local market.
The slaughterhouse has the following departments:

- 1 slaughtering line with the above-mentioned capacity
- 1 cutting-room department 9 t/shift, two-shift operation
- 1 boiling house department 1 t/shift, two-shift operation
- 1 by-product processing plant 6 t/shift, three-shift operation to use all slaughtering by-products obtained, such as condemned organs, bones, offals, blood. See item 6.04.

In the plan year 85/86 47,200 sheep have been planned for slaughter. But up to now no sheep has been slaughtered, so that the following evaluation of by-product processing can only refer to cattle slaughter.

5.05.02. Store animal supply

The ELIDCO Meat Factory disposes of a wide pasture area situated inside of a 3000 ha quarantine centre. Before slaughter livestock is kept there for 1 to 2 months, controlled by veterinarians, and vaccinated above all against rinderpest.
At the same time there is a certain fattening of cattle with an average increase in weight of 200 g/animal and day.
From the quarantine centre animals are driven to the slaughterhouse being 25 km away. There they are pastured again before slaughter.

The capacity of the pasture is sufficient for about 20 slaughtering days. Animals pass a second veterinary control, weighing, and classification for the respective export purpose. As a whole this system can be regarded as exemplary.

5.05.03. Slaughter / cattle

Basically the applied slaughtering technology comes up to the European standard, only skinning is still by hand.
By-products are collected and supplied mainly to animal body meal production.

5.05.04. Kind, quantity, and quality of by-products / cattle

Kind and quantity of obtained by-products are listed in detail in table 5.05.-01.
The quantity of obtained by-products totals (including bones from cutting-up) 11,249.2 t per year. In case of full use of all by-products and with regard to the present conditions in animal keeping, animal hygiene, etc the following quantities could be used with appropriate technological equipment

- for human consumption 2,053.0 t
- for industrial use 9,196.0 t.

At present only the following quantities are used

- for human consumption 517.0 t
- for industrial use 6,934.0 t.

The remaining 3,798.0 t are not used. This refers above all to blood, horns, tails, masks, and stomach and intestine contents. The reason why these parts are not used lie in the defect processing plant and lacking experience concerning the use of horn material. The obtained manure is washed away with sewage water and not supplied to agricultural use.

5.05.05. Kind, quantity, and quality of used by-products, possibilities of quality increase / cattle

The following parts are used for human consumption after subtraction of condemned slaughter: liver, kidneys, spleen, heart, lung, throat meat, and tongue.
All condemned organs, stomachs, and intestines as well as glands and the whole head are supplied to animal body meal production.
The quality of all these products comes up to the respective purpose. Higher refining, particularly of glands, intestines, and paunch, up to the use of the brain would be recommended with respective modification of winning.

5.05.06. Kind, quantity, and quality of by-products not used at present

Kind and quantity are shown in table 5.05.-01.
The quality of unused by-products is the following:

Brain: Is not won, skull remains as a whole, does not meet eating habits and export possibilities of the enterprise.

Blood: By-product for human consumption, can only be utilized by changeover of the winning method. Use and production of blood plasm for sausage production in the State sector would be possible.

5.05.07. By-products treated in processing plants

The main by-products processed in industry can also be gathered from table No. 5.05.-01.
The table shows that nearly all obtained by-products, which can be used in industry, are supplied to meat and bone meal production.

5.05.08. Modification of slaughterhouse operations in favour of maximum by-product winning / cattle

By use of the existing technological equipment or its repair the following by-products may be won in addition:

Blood: Blood during killing has to be collected in separate vessels, stirred, and may be supplied to sausage production. Appropriate sausage recipes have to be elaborated for the existing tinnery.
Processing to blood plasm would be worthwhile as well.
Seeping and thick blood have to be used for meal production.

Tails and masks: Tails have to be won and supplied to processing industry. Masks and remaining bone material have to be added to animal body meal winning.

Horn material: The obtained horn material has to be heat-treated and supplied to meal production.

Contents of stomachs and intestines: Components from the gastro-intestinal tract, which are washed away in the sewage water, have to be separated and used in agriculture after composting.

Glands: The obtaines glands are also used for animal body meal production. Better utilization is possible, if these raw materials could be exported for pharmaceutical industry.

Intestines: In future intestines have to be removed, emptied, cleaned, deslimed, and salted for intermediate storage. So intestines may be used at home as sausage skin or exported.

Paunch: After treatment paunch has to be cleaned in a scraping machine and provided for human consumption fresh butchered or through sausage production.

Brain: For winning the skull has to be splitted. Brain has to be sold as fresh product or processed in sausage production.

Spinal marrow: In future the animal body has to be split in the middle. Spinal marrow has to be processed analogously to brain.

5.05.09. Economical review

Investments

To put the modification suggestions into practice as described under item 5.05.08. the following investments are necessary:

For blood winning:

	local currency	foreign currency
	birr	birr
2 blood containers at 200 l each, mobile	3,200.-	-
1 centrifuge for plasm winning	-	12,000.-
1 paunch scraping machine	-	15,000.-
6 work-tables with basin and hot water and cold water supply	4,000.-	-
1 cattle intestine processing machine	-	50,000.-
total	84,200.-	

For additional winning of tails, masks, horns, glands, stomach and intestine contents new investments are not necessary. Existing equipment may be used.

Labour

for blood winning and plasm production	2 workers
for gland winning	3 workers
for preparation of tails and masks	2 workers
for intestine processing	12 workers
for paunch processing	1 worker
	20 workers

Additional current costs

wages for 20 workers		13,300.- birr/a
maintenance, attendance		9,000.- birr/a
depreciation 10 % of 84,200.-		8,400.- birr/a
		30,700.- birr/a

Extra receipts

blood - plasm	285.0 t	171,000.- birr/a
tails (hair)	0.5 t	900.- birr/a
glands	29.7 t	148,000.- birr/a
intestines, salted	1,980 Tm	198,000.- birr/a
paunch	850.0 t	850,000.- birr/a
		1,367,900.- birr/a

Cost-benefit-analysis

receipts:	1,367,900.- birr/a
costs:	30,700.- birr/a
proceeds:	1,337,200.- birr/a

profit: proceeds - funds payment (20 %)

1,337,200.- - 267,440.- = 1,069,760.- birr/a

rate of return: $\frac{\text{investments}}{\text{profit}} = \frac{84{,}200.\text{- birr}}{1{,}069{,}760.\text{- birr/a}} = 0.07$ years

Table No 5.05.-01

Review of by-products - MALGE WONDO - ELIDCO Meat Factory (slaughterhouse)

Animal: cattle

Kind of by-product	By-product per head kg	By-product per year t	By-product for human consumption used t/a	unused t/a	By-product for ind. purposes used t/a	unused t/a
Legs	6.1	402.6	-	-	402.6	-
Confiscate	8.5	561.0	-	-	561.0	-
Tallow	1.4	92.4	-	92.4	92.4	-
Fodder blood	2.6	264.0	-	-	-	264.0
Processing blood	6.0	567.6	-	567.6	-	-
Plasm	-	-	-	-	-	-
Intestines	9.4	620.4	-	-	620.4	-
Skin	29.4	1,940.4	-	-	1,940.4	-
Contents of stomach and intestine	41.1	2,712.6	-	-	-	2,712.6
Bons from deboning		1,303.0	-	-	1,303,0	-
Total		11,249.2	516.8	1,536.4	6,934.1	3,230.7

5.06. ASMARA - SOPRAL MEAT FACTORY (Slaughterhouse)

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5.06.01 General description

5.06.02 Suggestions for modification

Table:

5.06.-01 Results of test slaughtering

5.06.01. General description

The SOPRAL Slaughterhouse enterprise is a branch of LIMCOR and disposes of a slaughtering plant with a capacity of about 100 cattle per shift. The plant can be operated in three shifts. Appropriate cold storage capacities with hoisting devices are available.

On the enterprise's grounds processing of all ba-products is possible except hide treatment. Caused by lacking store animal supply this enterprise has been out of operation for 12 years. The existing by-product processing plant for the production of animal body and bone meal shows a low degree of wear and is in working order. At present the major part of production rooms is used for foreign purposes or storage. A change of this situation is not expected in the near future. Evaluation of the applied slaughtering technology and quality of obtained by-products was not possible for the above-mentioned reasons. Detailed assessment of quantity and quality could not be made.

As stated by the partner all obtained by-products, such as organs, intestines, lower legs, heads, etc. could be exclusively supplied to animal body meal production.

At present the range of production comprises only home-grown canned vegetables, soups, and beans for exportation. There is no processing of by-products from the meat sector. For that reason further assessment of by-product processing does not apply. The economic evaluation cannot be evaluated because of the present situation.

5.06.02. Suggestions for modifications

Even if from the present point of view, a soon production start in the SOPRAL slaughterhouse seems not to be possible, the slaughterhouse should be kept for a later reintroduction in the slaughtering process, by the permanent maintenance of the plant.

The started construction measures for a store animal supply area should be finalized. Modifications of the technical equipment and of the existing buildings will not be proposed presently.

Table No 5.06.-01

Results of test slaughtering - SOPRAL Meat Factory Asmara 1978 E.C.

MINISTRY OF STATE FARM DEVELOPMENT

ETHIOPIAN LIVESTOCK & MEAT CORPORATION

	1	2	3			
			CARCASS WT.			
No	EAR TAG	LIVE WT. kg	FRESH kg	CHILLED kg	DIFFERENCES kg	CARCASS WT. TO LIVE WT. %
	1	2	3.1	3.2	3.3	$\frac{3.2 \times 100}{2}$
1	5229	202	89	83.5	5.5	41.33
2	5230	255	123	117.3	5.7	46.00
3	5231	237	103	97.7	5.3	41.22
4	5232	209	88	83.2	4.8	39.80
5	5233	173	74	68.0	6.0	39.80
6	5234	226	93	87.7	5.3	38.80
7	5235	223	94	[illegible]	5.7	39.59
8	5236	227	94	88.[illegible]	5.5	38.98
9	5237	240	103	97.[illegible]	5.7	40.54
10	5238	221	100	9[illegible]	5.5	42.76
11	5239	212	99	9[illegible].7	5.3	44.18
12	5240	210	92	8[illegible].5	5.5	41.19
13	5241	181	76	69.7	6.3	38.50
14	5242	210	85	79.4	5.6	37.80
15	5243	209	84	80.0	4.0	38.27
16	5244	242	105	97.8	7.2	40.41
17	5245	231	102	96.5	5.5	41.77
18	5246	206	88	82.4	5.6	40.00
19	5247	214	90	85.3	4.7	39.85
20	5248	253	108	102.6	5.4	40.55
21	5249	235	102	96.2	5.3	40.93
22	5250	242	102	96.0	6.0	39.66
Total		4868	2094	197.1	121.9	891.43
Average		220.61	95.18	89.64	5.54	40.51

Table No 5.06.-01

Results of test slaughtering - SOPRAL Meat Factory Asmara 1978 E.C.

MINISTERY OF STATE FARM DEVELOPMENT

ETHIOPIAN LIVESTOCK & MEAT CORPORATION

	4			
No	MEAT YIELD			
	UNTRIMMED kg	CLEAN- kg	TRIMMING kg	CLEAN MEAT TO CARCASS WT. %
	4.1	4.2	4.3	$\frac{4.2 \times 100}{3.2}$
1	63.7	55.8	7.9	66.82
2	93.4	81.3	12.1	69.30
3	74.7	64.2	10.5	65.71
4	67.0	49.3	7.7	59.25
5	46.3	36.3	10.0	53.39
6	64.7	52.1	12.6	59.40
7	62.6	57.3	5.3	64.89
8	62.8	53.2	9.6	60.11
9	71.7	63.9	7.9	65.57
10	76.0	66.4	8.6	70.26
11	71.7	62.0	9.7	66.16
12	63.0	59.5	3.5	68.78
13	50.7	41.4	9.3	59.39
14	56.0	46.7	9.3	58.81
15	58.7	47.5	11.2	59.37
16	75.0	64.0	10.0	65.43
17	74.4	67.0	7.4	69.43
18	57.2	43.9	13.3	53.27
19	65.0	60.9	4.1	71.39
20	75.4	56.5	18.9	55.86
21	72.3	61.8	10.5	64.24
22	68.9	58.6	10.3	61.04
Total	1460.2	1249.5	210.7	1387.04
Average	66.37	56.79	9.57	63.04

Table No 5.06.-01

Results of test slaughtering - SOPRAL Meat Factory Asmara 1978 E.C.

MINISTRY OF STATE FARM DEVELOPMENT

ETHIOPIAN LIVESTOCK & MEAT CORPORATION

	5	6	7	8	9	10	11	12	13	14
No	LIVER KG	TONGUE GMS	KIDNEY GMS	HEART GMS	RUMEN KG	LUNG KG	INTE-STINE KG	BONE KG	HIDE KG	SPLEEN GMS
1	2.0	700	500	700	10	2.5	5	30.7	13.0	400
2	2.3	900	500	700	11	2.5	6	32.0	16.0	900
3	2.3	700	500	700	12	2.6	6	31.8	17.0	500
4	2.0	600	500	500	9.5	2.3	6	33.0	19.0	300
5	1.6	500	500	400	8	2.0	5	25.8	12.0	300
6	2.0	600	500	600	10	2.0	5	30.9	13.0	300
7	1.7	800	500	500	9	2.6	5	30.5	15.0	300
8	2.4	600	500	600	10	2.5	5	34.3	14.0	400
9	2.5	600	500	700	11.5	3.0	7	31.4	17.3	400
10	2.4	600	500	600	10	2.5	7	31.1	15.5	400
11	2.5	600	500	600	11	2.5	6	27.8	14.3	400
12	1.6	500	500	600	8	2.7	4	26.0	15.0	200
13	2.0	500	500	600	9	2.0	6	25.7	13.5	200
14	2.2	500	500	800	10	3.0	4	28.7	13.0	500
15	1.8	700	500	500	10	2.2	6	27.1	16.0	300
16	2.3	700	500	700	10	2.5	5	30.0	19.0	300
17	2.7	800	500	600	12	2.6	5	28.7	13.0	500
18	2.0	800	500	600	9	2.5	6	32.3	18.0	300
19	2.1	500	500	600	9	2.2	4.5	25.4	15.0	400
20	2.3	800	500	600	9.5	3.0	5	34.0	17.0	400
21	2.3	600	500	600	12.5	2.4	6	30.3	16.0	400
22	2.2	700	500	600	10.5	2.7	6	34.0	17.0	400
Total	47.2	14200	11000	12.800	221.5	54.3	122.5	661.5	341.5	8100
Average	2.14	645.45	500.0	531.31	10.06	2.49	5.56	30.04	15.52	368.18

5.07. ASMARA - INCODE Slaughterhouse

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5.07.07. By-products treated in processing plants
5.07.08. Modification of slaughterhouse operations in favour of maximum by-product winning
5.07.09. Economic evaluation

Table:

5.07.-01 Review of by-products

5.07.01. General description

The INCODE Slaughterhouse is a cattle slaughtering enterprise working seasonally from September to February. In this period about 15,000 - 20,000 animals are slaughtered.
Maximum daily output amounts to 150 - 200 head per shift.
In the period of visit no slaughters were carried out.
The following reflections refer to statements of the partner.
Exploitation is in one-shift operation. Slaughter, cold storage as well as processing of most of obtained by-products for animal body meal production are in the enterprise. All animal body halfs and quarters are cut up, and only the clean meat is supplied to the SOPRAL Meat Factory. All meat parts obtained during cutting-up which do not meet the clean meat parameters (with sinews and fat) are processed to animal body meal. The same applies to all organs which would be usable for human consumption except low quantities of kidneys which are sold to the workers if required.

5.07.02. Store animal supply

Animals for slaughter are directly bought up from local livestock markets and supplied to slaughter. There is no examination by a veterinarian before slaughter.
No service slaughters are done. Only male animals are supplied to slaughter.

5.07.03. Slaughter

The technological equipment of the plant shows a low degree of mechanization. Most of the operations are by hand. The existing building is layed out on a very large scale. Technological linkage to the neighbouring departments is possible.
After slaughter animals are hung for about five hours. Not before this the carcasses are supplied to cold storage (motionless cooling). Because of low cold storage capacity technology cannot be changed as stated by the partner.
According to his own statements cooling loss is about 5 %. The existing space would allow the setting-up of a shock tunnel. Necessary refrigeration equipment has to be determined and installed.

5.07.04. Kind, quantity, and quality of by-products

Table No 5.07.-01 shows kind and quantity of obtained by-products.
As it can be seen there is an extremely high rate of codemned organs caused by insufficient quality of animals for slaughter because of unfavourable conditions in animal breeding, keeping, and hygiene.
The yield of all by-products for the slaughtering period totals 3,259.0 t.
Of this quantity 425 t are usable for human consumption and 2,834.0 t, for industrial purposes after subtraction of condemned slaughter.
Actually there is no use for human consumption and 2,380.0 t are used for industrial purposes. 879 t are not used.
Quality of by-products obtained at present could not be treated at the moment of elaboration of this study.

5.07.05. Kind, quantity, and quality of used by-products - possibilities of quality increase

As stated by the partner all obtained used by-products are basically supplied to animal body meal production.
Kind and quantity of usable by-products are shown in table 5.07.-01. Quality assessment could not be made for the above-mentioned reasons.
Furthermore neat hide is used which is supplied to local tanneries either as fresh product or salted.

5.07.06. Kind, quantity, and quality of by-products not used at present

During the slaughtering period horns, blood, and stomachs as well as contents of intestines are not processed by the slaughterhouse. As stated by the partner there are no processing facilities, or production of blood meal does not cover the costs.

5.07.07. By-products treated in processing plants

As shown in the previous passage also by-products which are usable for human consumption are not used in the best possible way. Technological equipment of the slaughterhouse for use and processing of these products for consumption is available.

5.07.08. Modification of slaughterhouse operatios in favour of maximum by-product winning

All usable organs have to be won at the existing working places, treated, and stored in the cold storage house.
They have to be used for human consumption at home or for exportation. For this purpose there are enough technological possibilities for the use in sausages or canned sausages in the enterprises described under item 6.06. and item 6.08.
Appropriate recipes have to be elaborated.
For horn processing a technological process has to be conceived which allows winning of horn meal.
Intestines have to be won first of all as sausage skins as required by existing or developable sales possibilities at home or for exportation, treated, and preserved.
Only remaining intestines which are not yet marketable have to be supplied to animal body meal production.
In favour of efficient processing of all obtained kinds of glands the latter have to be won during the slaughtering process, preserved, and stored. Sales possibilities have to be opened up on the export market.
Blood has to be collected in separate vessels and used for sausage production or as protein addition in the form of plasm for human consumption in neighbouring enterprises as required by the circumstances. The remaining residual quantity of blood has to be supplied to animal body meal production through pipeline systems without addition of rinsing water.

As stated by the partner contents of stomachs and intestines were washed away with sewage water. Contents have to be collected separately, composted, and used in agriculture.
In the interest of minimum cold storage house shrinkage a fast-cooling tunnel has to be installed in the existing cold storage chamber. This cooling tunnel has to be designed for maximum capacity in favour of a high cooling effect and installed in the passage way where carcasses are hung at present. The shock tunnel has to work on the principle of interrupted fast cooling that means beef carcasses remain in this chamber for about 4 hours at an ambient temperature of - 8 to - 10° C and an air speed of 3.5 to 4 m/s.
The chamber has to be operated with suitable high-capacity refrigeratories and appropriate refrigerating plants from the power house.
It is expected that hide quality is reduced by manual skinning (cuts). Use of a mechanized skinning device has to be planned.
As described under item 5.07.01. there are enough capacity reserves with the present number of animals for slaughter in order to treat the slaughtering quantity from the City Slaughterhouse as well. This would diminish technological and hygienic insufficiencies and result in all-round use of by-products.
Further explanations see item 5.08.
In the suggested equipment specification the combination has been taken into account.

5.07.09. Economic evaluation

Investments

To put the modification suggestions into practice as described under item 5.07.08. the following investments are necessary:

	local currency	foreign currency
	birr	birr
a) Structural works		
- contents of stomachs and intestines		
1 dump ground 20 m x 10 m	5,000.-	-
- skinning		
1 foundation for skinning device	1,000.-	-
	6,000.-	
b) Technical equipment		
- for blood processing		
1 centrifuge	-	12,000.-
2 storage tanks	3,200.-	-
10 plastic barrels at 100 l each	-	1,000.-
for intestine and gland winning		
2 freezer chests at 400 l each	-	8,000.-
1 desliming machine	-	40,000.-
10 worktables	5,000.-	-
15 sinks with hot-water supply	7,500.-	-
30 plastic barrels at 100 l each	-	3,000.-
- cooling tunnel		
1 condenser, complete	-	90,000.-
1 electrovalve station	-	20,000.-
10 high-capacity refrigeratories	-	90,000.-
conveying equipment	-	20,000.-
- skinning		
1 skinning device	-	10,000.-

Labour

for blood winning / processing		1 worker
for intestine and gland winning		27 workers
	plus	28 workers

Additional current costs:

wages, salaries	19,961.- birr/a
maintenance, attendance, repair	37,163.- birr/a
depreciation	30,970.- birr/a
	88,100.- birr/a

Extra receipts

- blood plasm	105.0 t	36,750.- birr/a
- intestines	1,110,000 m	111,000.- birr/a
- glands	17.0 t	85,000.- birr/a
- red meat (by saving of cooling losses)	22.2 t	88,800.- birr/a
- compost	463.0 t	4,630.- birr/a
- organs for direct human consumption	394.0 t	788,000.- birr/a
		1,114,180.- birr/a

Cost-benefit-analysis

receipts:	1,114,180.- birr/a
costs:	88,100.- birr/a
proceeds:	1,026,079.- birr/a
profit: proceeds - funds payment	820,864.- birr/a

rate of return: $\frac{\text{investments}}{\text{profit}} = \frac{315,700.-}{820,864.-} = 0.38$ years

Table No 5.07.-01:

Review of by-products - ASMARA - INCODE Slaughterhouse

Kind of by-products	By-products per head kg	By-products per year t	By-products for human consumption used t/a	By-products for human consumption unused t/a	By-products for ind. purposes used t/a	By-products for ind. purposes unused t/a
Liver	3.0	52.5	-	31.4	52.5	-
Kidneys	0.8	14.0	-	11.4	14.0	-
Spleen	0.7	12.3	-	12.0	12.3	-
Heart	1.0	17.5	-	16.3	17.5	-
Lung	3.4	59.5	-	44.8	59.5	-
Throat	0.3	5.3	-	3.6	5.3	-
Paunch Rumen Stomach	15.2	266.0	-	150.0	266.0	-
Head	12.0	210.0	-	-	210.0	-
Tongue	1.1	19.3	-	17.6	19.3	-
Brain	0.3	5.3	-	4.4	5.3	-
Mouth Mask	3.2	56.0	-	-	56.0	-
Udder	-	-	-	-	-	-
Spinal marrow	0.1	1.8	-	1.8	1.8	-
Pancreas	0.2	3.5	-	-	3.5	-
Suprarenal body	0.05	0.9	-	-	0.9	-
Gall	0.15	2.6	-	-	2.6	-
Gallbladder peel	0.05	0.9	-	-	0.9	-
Ear ends	0.05	0.9	-	-	0.9	-
Tail	0.1	1.8	-	-	1.8	-
Horn	0.5	8.8	-	-	-	8.8

Table 5.07.-01:

Review of by-products - ASMARA - INCODE Slaughterhouse

Kind of by-products	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Legs	6.1	106.8	-	-	106.8	-
Confiscates	8.5	148.8	-	-	148.8	-
Tallow	1.4	24.5	-	24.5	24.5	-
Fodder blood	2.6	59.5	-	-	-	59.5
Processing blood	6.0	91.0	-	91.0	-	91.0
Plasm	-	-	-	-	-	-
Intestines m/head - small - medium - large - bladders - fat ends total output	9.4	164.5	-	-	164.5	-
Skin	29.4	514.5	-	-	514.5	-
Contents of stomachs and intestines	41.1	719.3	-	-	-	719.3
Bones from the deboning section		525.0	-	-	525.0	-
Trimming meat		166.3	-	166.3	166.3	-
Total		3,259.1	-	575.1	2,380.5	878.6

5.08. ASMARA - City Slaughterhouse

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5.08.07. Modification of slaughterhouse operations in favour of maximum by-product winning

Table:

5.08.-01 Review of by-products

5.08.01. General description

The Asmara City Slaughterhouse is subordinate to the local municipal authorities and does only service slaughter ordered by animal owners. Above all private butcher's shops belong to the customers, but also the Meat Processing Factory.
Slaughtering of cows is prohibited in principle except emergency and disease slaughters. Immediately after slaughtering carcasses are transported by vehicles to the customers. The enterprise does not have any cold storage facilities.
Because of the low slaughter rates of sheep and pig amounting to less than 1,000 head per year the yield of by-products is low and not subject of any further reflections.
At the moment of these investigation neither the one nor the other species was supplied to slaughter. For that reason only cattle slaughtering is subject of the present evaluation. The slaughterhouse has a maximum capacity of about 170 cattle per day in one-shift operation.

5.08.02. Store animal supply

Animals for slaughter are driven to the collecting place by the customers, examined by veterinarians, and supplied to slaughter after a 24-hour recreation break. Animals are marked with numbers of the customers.

5.08.03. Slaughter

Technology shows a low degree of mechanization. The principle of individual slaughter is applied. It is striking that neat hide was correctly won.
However, the practised slaughtering technology causes contaminations and confusions of carcasses and dangers for the workers
Contaminations are mainly caused by slaughtering on the floor.
Improvements are possible by mechanization. The fresh-slaughtered carcasses are supplied to dispatch.

5.08.04. Kind, quantity, and quality of by-products

Table No 5.08.-01 shows kind and quantity of obtained by-products. Like in the enterprises inspected up to now there is a high rate of condemned organs as well.
The yield of all by-products totals 2,934.0 t/a.
Of this quantity 405.0 t less condemned slaughter may be used for human consumption. By complete utilization of intestines for human consumption 505.0 t are used as stated by the partner.
On the basis of this higher utilization 2,429 t could be used for industrial purposes. Actually only 787.0 t are processed.
The residual quantity is burned on a dump ground outside the town - 1,642 t.
Winning of by-products corresponds to the existing possibilities and would allow use for human consumption to a limited extent.

5.08.05. Kind, quantity, and quality of used by-products, possibilities for quality increase

Contrary to the slaughterhouse inspected up to now a high percentage of organs and other by-products is used depending on eating habits.

Liver: Condemned slaughter rate of 40 %, remaining part used for human consumption

Kidneys: Condemned slaughter rate of 12 %, remaining part used for human consumption

Heart: Condemned slaughter rate of 7 %, remaining part used for human consumption

Tongue: Condemned slaughter rate of 9 %, remaining part used for human consumption

Suet: no condemned slaughter, completely used for human consumption

All above-mentioned parts are correctly won, washed, and supplied to the customer together with the carcass.

Stomachs: Paunch is correctly removed, separated from intestines, and transported to an intestine processing department. There stomachs are separated, emptied, and roughly cleaned. Stomachs are returned to the customer who uses the paunch for consumption after appropriate preparation. The other stomachs are sold as animal food. To improve paunch quality immediate fine cleaning with hot water would be recommended.

Intestines: Intestines are separated and rinsed. There is no further treatment such as turning and desliming. They are freshly returned to the customer who uses them for certain dishes which are customary in this country. Thorough cleaning with hot water would be suitable.

Mouths and masks: These parts are separated from the head. washed, and freshly supplied to use for handicraft purposes. Quality came up to requirements.

Tails, horn and lower legs: These parts are won separately and also freshly supplied to handicraft purposes in existing small-size enterprises without previous treatment. Quality came up to requirements.

Hides: Hides were correctly won. Hardly any cuts could be seen, and also fat and meat parts were low (best hide quality up to now).
Further treatment consists only in washing.
Afterwards hides are freshly supplied to tanneries.

5.08.06. Kind, quantity, and quality of by-products not used at present

For kind and quantity see table No 5.08.-01.

Concerning quality:

Spleen:	At present only used as animal food. Use for human consumption is recommended.
Lungs:	At present used as animal food, use for human consumption would be possible.
Throat:	Throat meat has to be separated from the windpipe, cleaned and supplied to human consumption (sausage production). Up to now used for feeding purposes.
Stomachs without paunch:	At present stomachs are treated, emptied, and rinsed. Use for animal body meal production is recommended.
Brain:	Remains in the skull. The latter has to be split and used in sausage products or for canning.
Spinal marrow:	The spinal canal has to be split in the middle, spinal marrow has to be won and used in sausage products or for canning.
Glands:	Have to be won during the slaughtering process, treated, and stored as required by their purpose.
Confiscates:	Are supplied to burning. For better utilization processing to animal body meal is recommended.
Blood:	Is washed away with sewage water. Blood from killing has to be collected in separate vessels and used for human consumption or plasm production. Usability depends on the respective type of sausage or canned food. Has to be sold to the Meat Factory. Seeping blood has to be won and supplied to blood meal production.
Contents of stomachs and intestines:	At present this by-product is supplied to burning. It is recommended to compost contents of stomachs and intestines and supply them to agricultural use.

5.08.07. Modification of slaughtering plants

For all-round use of by-products detailed remarks are made under item 5.07.08. concerning utilization of existing slaughter capacities. For the City Slaughterhouse further modification and also evaluation related to economy do not apply.

Table No 5.08.-01:

Review of by-products - ASMARA City Slaughterhouse

Animal: cattle

Kind of by-product	By-product per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Liver	3.0	60.0	35.9	-	-	24.1
Kidneys	0.8	16.0	14.1	-	-	1.9
Spleen	0.7	14.0	-	13.6	-	0.4
Heart	1.0	20.0	18.6	-	-	1.4
Lung	3.4	68.0	-	51.2	-	16.8
Throat	0.3	6.0	-	3.9	-	2.1
Paunch Rumen Stomach	15.2	304.0	200.0	-	-	104.0
Head	12.0	240.0	-	-	-	240.0
Tongue	1.1	22.0	20.1	-	-	1.9
Brain	0.3	6.0	-	5.9	-	0.1
Mouth Mask	3.2	64.0	-	-	64.0	-
Udder	-	-	-	-	-	-
Spinal Marrow	0.1	2.0	-	2.0	-	-
Pancreas	0.2	4.0	-	-	-	4.0
Suprarenal body	0.05	1.0	-	-	-	1.0
Gall	0.15	3.0	-	-	-	3.0
Gallbladder peel	0.05	1.0	-	-	-	1.0
Ear ends	0.05	1.0	-	-	1.0	-
Tail	0.1	2.0	-	-	2.0	-
Horn	0.5	10.0	-	-	10.0	-

Table No 5.08.-01:

Review of by-products - ASMARA City Slaughterhouse

Animal: cattle

Kind of by-product	By-product per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Legs	6.1	122.0	-	-	122.0	-
Confiscates	8.5	170.0	-	-	-	170.0
Tallow	1.4	28.0	28.0	-	-	-
Fodder blood	2.6	52.0	-	-	-	52.0
Processing blood	6.0	120.0	-	120.0	-	-
Plasm	-	-	-	-	-	-
Intestines m/head						
- small - medium - large - bladders - fat ends	9.4	188.0	188.0	-	-	-
Skin	29.4	588.0	-	-	588.0	-
Contents of stomachs and intestines	41.1	822.0	-	-	-	822.0
Total		2,934.0	504.7	196.6	787.0	1,445.7

5.09. KOMBOLCHA - SOPRAL Slaughterhouse

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5.09.06. By-products treated in processing plants

5.09.07. Modification of slaughterhouse operations in favour of maximum by-product winning

5.09.08. Economic evaluation

Table:

5.09.-01 Review of by-products

5.09.01. General description

The SOPRAL Slaughterhouse is an enterprise of LIMCOR which purchases all animals for slaughter from the local livestock market or directly from State farms.
Service slaughters are not done. A by-product processing plant, a cutting-up and canning department which are described in detail under item 6.06. and 6.09. are subordinate to this enterprise.
In the following the slaughtering process and by-product winning are considered. The maximum slaughter capacity is 200 cattle per shift. Under the present conditions only 75 cattle are slaughtered in one-shift operation.
The whole enterprise has about 500 workers, is situated outside the town, and disposes of all technical equipment for maximum utilization of all obtained products.
Furthermore storing space for deep-frozen products with an overall capacity of 34 t exists on the enterprise's grounds.

5.09.02. Store animal supply

Store animals are kept in four boxes at 130 cattle each three days before slaughter. 24 hours before slaughter animals are driven into a quarantine zone and examined by a veterinarian. Furthermore their live weight is determined.

5.09.03. Slaughter

The slaughtering plant shows an average degree of mechanization and is equipped with manual conveying devices.
Supply to the by-product processing plant is the nest possible from technological aspects. Immediately after slaughtering carcasses are transported to the cold storage chamber and supplied to the cutting-up department for deboning after one day on an average. There is a separate slaughterroom for emergency slaughter animals.

5.09.04. Kind, quantity, and quality of by-products

The yield of by-products totals 4,044 t per year. From this quantity 239.0 t are supplied to human consumption and 3,803.0 t, to industrial use.
Addition of used by-products amounts to a difference of only 2 t which is caused by unused tails. For this product there is no market in the Kombolcha region at the moment.

5.09.05. Kind, quantity, and quality of used by-products - possibilities of quality increase

The exact quantity of used by-products per kind of product is shown in table 5.09.-01.
Quality is the following:

Liver: Condemned slaughter rate of 90 %, quality meets requirements

Kidney: Condemned slaughter rate of 20 %, are correctly separated from suet, quality meets requirements

Spleen: Condemned slaughter rate of 2.5 %, quality meets requirements

Heart: Condemned slaughter rate of 5.0 %, quality meets requirements

Lung: Condemned slaughter rate of 25.0 %, is not separated from windpipe, would allow processing for human consumption. At present completely supplied to animal body meal production together with throat and windpipe.

Stomach: Paunch is won, washed, scalded, and cleaned in a scraping machine, and freshly supplied to human consumption. Quality meets requirements.
Residual stomachs are used for animal body meal production after cleaning.

Head: Head is correctly won, separated from the carcass, and skinned. There is not splitting of the head for brain winning. The whole head is supplied to animal body meal production.

Tongue: Is separated from the head together with muscle meat and freshly supplied to consumption. Quality meets requirements.

Brain: Is not won up to now. Quality would meet requirements (for human consumption).

Mouth and masks: Are correctly won and supplied to animal body meal production.

Udder: Is not obtained because only bulls are supplied to slaughter.

Spinal marrow: Remains in spinal canal and is supplied to animal body meal production together with bones. Quality would be suitable for human consumption.

Glands: All kinds of glands are supplied to animal body meal production. Quality meets requirements as raw material for pharmaceutical industry.

Tallow: Is correctly won, quality meets requirements, at present used for animal body meal production.

Tails: Are not used at present. Quality meets requirements for industrial processing (brush fabrication).

Horn: Is correctly won and supplied to local handicraft firms. Processing to horn meal would be possible.

Lower leg: Quality meets requirements, are supplied to animal body meal production.

Blood: There is not yet a distinction between blood from killing and seeping blood at the moment, but would be possible. Plasm is not won either.

Intestine: Are cleaned and supplied to animal body meal production at present. Use as sausage skins would be possible after respective cleaning as far as quality is concerned.

Hide: Hide is correctly won and meets quality requirements.

Contents of stomach and intestines: Are won, composted, and supplied to agricultural use, quality meets requirements.

5.09.06. By-products treated in processing plants

Like shown in table 5.09.-01 all obtained suitable by-products are processed to animal body meal at present already.
The only exception is tail hair. The day of report two cattle were slaughtered for demonstration purposes.
The processing plant was not set into operation for economical reasons. The indicated quantities are statistical average values as stated by the partner.

5.09.07. Modification of slaughterhouse operations in favour of maximum by-product winning

Spleen: Spleen has to be supplied to sausage production and canning instead of supply to animal body meal production. Unusable quantities have to be supplied to the present purpose.

Lung: Lung has to be supplied to sausage production and canning instead of supply to animal body meal production. Unusable quantities and condemned slaughter have to be supplied to the present purpose. Future treatment and winning of lung has to be carried out in the cutting-up department where the windpipe has to be removed.

Throat: Throat meat has also to be won, opened, and cleaned in the cutting-up department. Afterwards supply to sausage production.

Spinal marrow: The spinal canal has to be split in the middle, spinal marrow has to be removed and supplied to sausage production.

Brain: The head has to be split, and the brain has to be supplied to sausage production.

Blood: In blood winning a distinction has to be made between blood during killing for human consumption and seeping blood for feeding purposes. Blood from killing has to be collected in separate vessels and supplied to sausage production. In case of a high yield of this kind of blood which exceeds the possible use plasm has to be produced and utilized in boiling sausages. Thick blood obtained from centrifugation has to be supplied to animal body meal production together with seeping blood.

Intestine: The actual use of intestines does not come up to the requirements to gain maximum operating profits. Intestines should be cleaned, deslimed, salted, and used as sausage skins.

Gland: Glands have to be won in separate kinds, put in intermediate storage, and supplied to pharmaceutical industry at home and abroad.

5.09.08. Economic evaluation

Investments

To put the modification suggestions into practice as described under item 5.09.07. the following investments are necessary:

	local currency	foreign currency
	birr	birr
a) Structural works	-	-
b) Technical equipment		
- for blood processing		
1 centrifuge	-	12,000.-
2 storage tanks at 200 l each	3,200.-	-
5 plastic barrels at 100 l each	-	500.-
- for intestine and gland winning		
1 desliming machine	-	40,000.-
5 worktables	2,500.-	-
5 sinks with hot-water supply	2,500.-	-
2 freezer chests at 200 l each	-	4,000.-
	8,200.-	56,500.-
total	64,700.-	

Labour:

for blood winning and processing	1 worker
for intestine and gland winning	8 workers
for winning of spleen, lung, throat, spinal marrow, and brain	2 workers
	11 workers

Additional current costs:

wages	7,260.- birr/a
maintenance, attendance, repair	7,760.- birr/a
depreciation	6,470.- birr/a
	21,490.- birr/a

Extra receipts

glands	9.0 t	45,000.- birr/a
intestines	594,000 m	59,400.- birr/a
blocd plasm	60.0 t	21,000.- birr/a
organs for direct human consumption as indicated in tables	77.0 t	154,000.- birr/a
		279,400.- birr/a

Cost-benefit-analysis

receipts:	279,400.- birr/a
costs:	21,490.- birr/a
proceeds:	257,900.- birr/a
profit: proceeds - funds payment	206,325.- birr/a

rate of return: $\frac{\text{investments}}{\text{profit}} = \frac{64,700.-}{206,325.-} =$ 0.31 years

Table No 5.09.-01:

Review of by-products - KOMBOLCHA - SOPRAL Slaughterhouse

Kind of by-product	By-product per head kg	By-product per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Liver	3.0	59.7	6.0	-	53.7	-
Kidneys	0.8	15.9	12.7	-	3.2	-
Spleen	0.7	14.0	-	13.6	14.0	-
Heart	1.0	19.9	18.9	-	1.0	-
Lung	3.4	67.6	-	50.7	67.6	-
Throat	0.3	6.0	-	3.9	6.0	-
Paunch Rumen Stomach	15.2	302.4	181.5	-	120.9	-
Head	12.0	238.8	-	-	238.8	-
Tongue	1.1	21.9	20.0	-	1.9	-
Brain	0.3	6.0	-	5.9	6.0	-
Mouth Mask	3.2	63.7	-	-	63.7	-
Udder	-	-	-	-	-	-
Spinal marrow	0.1	2.0	-	2.0	2.0	-
Pancreas	0.2	4.0	-	-	4.0	-
Suprarenal body	0.05	1.0	-	-	1.0	-
Gall	0.15	3.0	-	-	3.0	-
Gallbladder peel	0.05	1.0	-	-	1.0	-
Ear ends	0.05	1.0	-	-	1.0	-
Tail	0.1	2.0	-	-	-	2.0
Horn	0.5	10.0	-	-	10.0	-

Table No 5.09.-01

Review of by-products - KOMBOLCHA - SOPRAL Slaughterhouse

Kind of by-product	By-product per head kg	By-product per year t	By-products for human consumption used t/a	By-products for human consumption unused t/a	By-products for ind. purposes used t/a	By-products for ind. purposes unused t/a
Legs	6.1	121.4	-	-	121.4	-
Confiscate	8.5	169.2	-	-	169.2	-
Tallow	1.4	27.9	-	27.9	27.9	-
Fodder blood	2.6	51.7	-	-	51.7	-
Processing blood	6.0	119.4	-	119.4	119.4	-
Plasm	-	-	-	-	-	-
Intestines m/head - small - medium - large - bladders - fat ends total output	9.4	187.1	-	-	187.1	-
Skin	17.5	348.3	-	-	348.3	-
Contents of stomachs and intestines	41.4	817.9	-	-	817.9	-
Bones from the deboning section		1,361.0	-	-	1,361.0	-
Total		4,043.8	239.1	223.4	3,802.7	2.0

5.10. DIRE DAWA - Meat Factory (Slaughterhouse)

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5.10.08. Modification of slaughterhouse operations in favour of maximum by-product winning
5.10.09. Economic evaluation

Table:

5.10.-01 Review of by-products

5.10.01. General description

The Dire Dawa Meat Factory is an enterprise of the Ethiopian Livestock and Meat Corporation. The enterprise is situated outside the town and comprises a cattle slaughter line with a technological capacity of 150 animals per shift, a cutting-up department with the same capacity, a canning department for corned beef production for the export market and vegetable production for the home market. All departments are run in one-shift operation.
The yield per slaughtering period amounts to 15,000 cattle.
The enterprise was set into operation in 1963. It has own water and steam supply as well as factory-owned wells which dispose of enough free reserves for possible extension of the enterprise or the product range. The enterprise does not work continuously. There is a slaughtering period from September to April.
During the remaining period only canned vegetables are produced.
The enterprise works on the basis of the purchasing system.
There are no service slaughters.

5.10.02. Store animal supply

There are several pastures inside the enterprise's grounds in which 1,200 - 1,400 cattle may be driven. After a 24-hour quarantine time veterinarians inspect the store animals. The major part is purchased from State farms.

5.10.03. Slaughter

The slaughtering plant shows a relatively high degree of mechanization and is, as a whole, the most modern plant in Ethiopian meat industry.
There were an apparatus of horn cutting, a mechanized skinning device, and a chest and carcass saw were part of the technological equipment. Transport of carcasses along the slaughtering line is by hand. The existing cold storage capacity is designed for the slaughtering output. Obtained organs are supplied to the neighbouring departments by chutes and channels.

A veterinary inspection is made during the slaughtering process.

5.10.04. Kind, quantity, and quality of by-products

Kind and quantity are shown in table 5.10.-01.
The yield per slaughtering period totals 2,705.0 t.
From this quantity could be utilized

for human consumption	337.0 t
for industrial use	2,368.0 t.

Actually only the following quantities are used:

for human consumption	197.0 t
for industrial use	449.0 t.

This results in a deficit of 2,014.0 t which remains unprocessed at present. The cause of this deficit is that no processing plants for animal body meal production exist at Dire Dawa and its environs. All condemned organs including intestines, masks, lower legs, etc are not processed and burned on a dump ground. By-products obtained during the slaughtering process would allow processing for human consumption and industrial use as far as quality is concerned.

5.10.05. Kind, quantity, and quality of used by-products, possibilities of quality increase

By-products which are used at present are shown in table 5.10.-01.
An exceptionally high percentage of condemned organs is characteristic also of this site. Usable organs such as liver, kidneys, heart, tongue, and paunch are sold together to the population at the price of 3.50 birr.
Quality of these products is good. Spleens, lungs with throat, and obtained heads are not used for human consumption. These products are supplied to a pig farm and fed. Neat hides are correctly won, cleaned a second time, dried, and supplied to the capital for processing or exportation.
Hides show a high slaughtering damage rate.

5.10.06. Kind, quantity, and quality of by-products not used at present

By-products not used at present total 2,014.0 t. The different products can be taken from table 5.10.-01.

Quality determination:

Condemned organs such as liver, kidneys, spleen, heart, lung with throat, tongue allow treatment in a processing plant as far as quality is concerned.
This applies also to stomachs, horn, lower legs, tallow, confiscates, fodder blood, and bones from cutting-up.

Not used for human consumption up to now:

Spinal marrow and brain: Processing in sausages would be possible, quality meets requirements.

Not used in industry up to now:

Glands:	Quality is suitable for pharmaceutical purposes.
Intestines:	Obtained intestines are correctly won. Processing to sausage skins would be possible.
Contents of stomachs and intestines:	Are already separated in the course of treatment, agricultural use is possible.
Bones:	Bones from the cutting-up department would allow processing to bone meal as far as quality is concerned.

5.10.07. By-products treated in processing plants

At present only neat hide is supplied to tanneries.
Further description does not apply to the site of Dire Dawa.

5.10.08. Modification of slaughterhouse operations in favour of maximum by-product winning

For optimum use of obtained by-products the following modifications have to be introduced into slaughtering technology:

Blood: In blood winning a distinction has to be made between blood during killing and seeping blood. From blood during killing blood plasm has to be won with a centrifuge which may be added to sausages or canned products.

Glands: Have to be removed from carcass and intestines, frozen, and stored as required by their use.

Intestines: Intestines have to be separated, cleaned, deslimed, salted, and stored in barrels until sale.

Brain and spinal marrow: The head has to be split, brain has to be removed and supplied to sausage production or canning together with the spinal marrow.

Contents of stomachs and intestines: Stomach and intestine contents which have already been separated have to be composted and supplied to agricultural use.

Spleen and lung with throat: These usable organs which were taken as pig food up to now have to be supplied to consumption by the development of new sausage recipes.

The inspection of the City Slaughterhouse described in chapter resulted in the recommendation to close this slaughterhouse as soon as possible for reasons of hygiene and industrial safety. The slaughterhouse of the Meat Factory has enough capacity to taken over the number of animals slaughtered in the City Slaughterhouse up to the present. Thereby by-products which are not usable for human consumption could be treated in the suggested by-product processing plant as well (chapter 10.04.).

5.10.09. Economic evaluation

Investments

To put the modification suggestions into practice as described under item 5.10.08. the following investments are necessary:

	local currency	foreign currency
	birr	birr
For blood winning		
1 centrifuge	-	12,000.-
2 storage tanks at 200 l each	3,200.-	-
10 plastic barrels	1,000.-	-
For gland winning		
4 freezer chests at 400 l each	-	16,000.-
For intestine winning		
1 desliming machine	-	40,000.-
8 worktables	4,000.-	-
8 sinks with hot-water supply	2,000.-	-
	10,200.-	68,000.-
total	78,200.-	

Labour

for blood winning and plasm production	1 worker
for gland winning	4 workers
for intestine winning	17 workers
for brain and spinal marrow	1 worker
for contents of stomachs and intestines	2 workers
for spleen, lung, and throat	1 worker
	26 workers

Additional current costs

wages	13,320.- birr/a
maintenance, attendance	9,380.- birr/a
depreciation	7,820.- birr/a
	30,520.- birr/a

Extra receipts

blood plasm	45.0 t	29,750.- birr/a
(45 t Meat Factory, 85 t City Slaughterhouse)		
glands	13.0 t	65,000.- birr/a
(7 t Meat Factory, 6 t City Slaughterhouse)		
intestines	846,000 m	84,600.- birr/a
(450,000 m Meat Factory, 396,000 m City Slaughterhouse)		
brain, spinal marrow	11.0 t	22,000.- birr/a
(6 t Meat Factory, 5 t City Slaughterhouse)		
spleen, lung, throat	82.1 t	164,200.- birr/a
(43.6 t Meat Factory, 38.5 t City Slaughterhouse)		
contents of stomachs and intestines	1,160.0 t	116,000.- birr/a
(617 t Meat Factory, 543 t City Slaughterhouse)		
	total	481,550.- birr/a

Cost-benefit-analysis

receipts:	481,550.- birr/a
costs:	30,520.- birr/a
proceeds:	451,030.- birr/a
profit: proceeds - funds payment	360,820.- birr/a

rate of return: $\frac{\text{investments}}{\text{profit}} = \frac{78{,}200.-}{360.820.-} =$ 0.22 years

Table 5.10.-01

Review of by-products - DIRE DAWA - Meat Factory

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Liver	3.0	45.0	13.5	-	-	31.5
Kidney	0.8	12.0	6.0	-	-	6.0
Spleen	0.7	10.5	-	10.3	10.3	-
Heart	1.0	15.0	12.8	-	-	2.2
Lung	3.4	51.0	-	30.6	30.6	20.4
Throat	0.3	4.5	-	2.7	2.7	1.8
Paunch Rumen Stomach	15.2	228.0	150.0	-	-	78.0
Head	12.0	180.0	-	-	180.0	-
Tongue	1.1	16.5	15.0	-	-	1.5
Brain	0.3	4.5	-	4.5	-	-
Mouth Mask	3.2	48.0	-	-	-	48.0
Udder	-	-	-	-	-	-
Spinal marrow	0.1	1.5	-	1.5	-	-
Pancreas	0.2	3.0	-	-	-	3.0
Suprarenal body	0.05	0.8	-	-	-	0.8
Gall	0.15	2.3	-	-	-	2.3
Gallbladder peel	0.05	0.8	-	-	-	0.8
Ear ends	0.05	0.8	-	-	-	0.8
Tail	0.1	1.5	-	-	-	1.5
Horn	0.5	7.5	-	-	-	7.5

Table 5.10.-01

Review of by-products - DIRE DAWA - Meat Factory

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Legs	6.1	91.5	-	-	-	91.5
Confiscates	8.5	127.5	-	-	-	127.5
Tallow	1.4	21.0	-	-	-	21.0
Fodder blood	2.6	39.0	-	-	-	39.0
Processing blood	6.0	90.0	-	90.0	-	-
Plasm	-	-	-	-	-	-
Intestines m/head - small - medium - large - bladders - fat ends	9.4	141.0	-	-	-	141.0
Skins	18.0	270.0	-	-	270.0	-
Contents of stomachs and intestines	41.1	616.5	-	-	-	616.5
Bones from the deboning section		675.0	-	-	-	675.0
Total		2,704.7	197.3	139.6	493.6	1,917.6

5.11. DIRE DAWA - City Slaughterhouse

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5.11.05. Kind, quantity, and quality of used by-products, possibilities of quality increase
5.11.06. Kind, quantity, and quality of by-products not used at present
5.11.07. By-products treated in processing plants
5.11.08. Modification of slaughterhouse operations in favour of maximum by-product winning

Table:

5.11.-01 Review of by-products

5.11.01. General description

The Dire Dawa City Slaughterhouse is subordinate to the municipal authorities and does exclusively service slaughter for butchers of the town. Slaughters are done for Christians as well as for Muslims in separate slaughterhalls. The major part (90 %) is slaughtered for Christians.
Every year about 13,200 cattle are supplied to slaughter. The building of the slaughterhouse is very worn out. There are no additional departments of any kind. None of the working rooms is tiled. Cold storage chambers do not exist. Warm water and steam are not supplied. The slaughterhouse is run in one-shift operation.

5.11.02. Store animal supply

Store animals are delivered by the customers and inspected by a veterinarian. They are supplied in the afternoon. Animals are not weighed before slaughter.

5.11.03. Slaughter

The supplied animals for slaughter are slaughtered in the evening. The average daily slaughtering output amounts to about 50 animals. Slaughtering technology is extremely primitive. There are no mechanized operations at all.
The principle is nest work.
Animals are slaughtered, gutted, and cut on the floor. During the slaughtering process they are roughly cut up. Caused by slaughtering on the floor there is a strong contamination of meat and offals. These conditions do not come up to the present requirements of correct winning of the raw material in any way viewed from aspects of technology as well as veterinary hygiene.

5.11.04. Kind, quantity, and quality of by-products

Kind and quantity of obtained by-products are shown in table 5.11.-01. The annual yield totals 1,786.0 t.
Of this quantity could be utilized:

for human consumption 277.0 t
for industrial use 1,509.0 t.

Actually only the following quantities are used:

for human consumption 154.0 t
for industrial use 238.0 t (hides).

This results in a deficit of 1,395.0 t which remains unprocessed at present.
In this slaughterhouse it is common practice that unprocessable products, in particular condemned organs,offals, etc, are thrown over the enterprise's wall and there eaten by carrion feeders (hyenas). By-products obtained during the slaughtering process allow only limited processing for human consumption.

5.11.05. Kind, quantity, and quality of used by-products - possibilities of quality increase

By-products used at present are shown in table 5.11.-01.
Also on this site an extremely high percentage of condemned organs, is characteristic.
Usable organs and paunch are returned to the customer together with the carcasses. Quality of these products is reduced by surface contamination. Spleens, lungs with throat are returned to the customer. The latter uses these products as dog food.
Hides are won and show partially large cuts.
Butt leather is often injured. Hides are air-dried in the slaughterhouse and delivered to local tanneries by the meat corporation.

5.11.06. Kind, quantity, and quality of by-products not used at present

Quantity of by-products not used at present totals 1,395.0 t per year. The different products are shown in table 5.11.-01.
The quality of the following condemned organs such as liver, kidneys, spleen, heart, lung with throat, tongue allows processing to animal body meal. This applies also to stomachs, horn, lower legs, tallow, confiscates, fodder blood, masks, and bones.
Brain is not used for human consumption. Processing in sausages would be possible. Quality comes up to requirements.
Glands are not used for industrial purposes. Quality would allow pharmaceutical use.

Intestines: Obtained intestines are removed. Processing to sausage skins would be possible.

Contents of stomachs and intestines: Are washed away with sewage water during treatment. Agricultural use after separation would be possible.

5.11.07. By-products treated in by-product processing plants

At present only neat hides are processed in tanneries.
For quality see item 5.11.03.

5.11.08. Modification of slaughterhouse operations in favour of maximum by-product winning

To achieve optimum use of obtained by-products very extensive technological and structural changes are necessary which would be equal to building a new slaughterhouse. Because the slaughterhouse of the Dire Dawa Meat Factory is about 500 m away it is recommended to carry out service slaughters in this enterprise. The existing buildings have to be used for the remaining Muslims slaughters.
By this change of organizational responsibility the deficit of 1,395.0 t of by-products could be utilized for human consumption as well as for industrial purposes by processing in the Meat Factory.
Based on this suggestion reflections related to managerial economics by use of by-products are already part of item 5.10.

Table No 5.11.-01

Review of by-products - DIRE DAWA - Slaughterhouse

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Liver	3.0	39.6	11.9	-	-	27.7
Kidney	0.8	10.6	5.3	-	-	5.3
Spleen	0.7	9.3	-	9.1	-	0.2
Heart	1.0	13.2	11.2	-	-	2.0
Lung	3.4	44.9	-	27.0	-	17.9
Throat	0.3	4.0	-	2.4	-	1.6
Paunch Rumen Stomach	15.2	200.6	112.2	-	-	88.4
Head	12.0	158.4	-	-	-	158.4
Tongue	1.1	14.5	13.2	-	-	1.3
Brain	0.3	4.0	-	4.0	-	-
Mouth Mask	3.2	42.2	-	-	-	42.2
Udder	-	-	-	-	-	-
Spinal marrow	0.1	1.3	-	1.3	-	-
Pancreas	0.2	2.6	-	-	-	2.6
Suprarenal body	0.05	0.7	-	-	-	0.7
Gall	0.15	2.0	-	-	-	2.0
Gallbladder peel	0.05	0.7	-	-	-	0.7
Ear ends	0.05	0.7	-	-	-	0.7
Tail	0.1	1.3	-	-	-	1.3
Horn	0.5	6.6	-	-	-	6.6

Table 5.11.-01

Review of by-products - DIRE DAWA - Slaughterhouse

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind.purposes used t/a	unused t/a
Legs	6.1	80.5	-	-	-	80.5
Confiscates	8.5	112.2	-	-	-	112.5
Tallow	1.4	18.5	-	-	-	18.5
Fodder blood	2.6	34.3	-	-	-	34.3
Processing blood	6.0	79.2	-	79.2	-	-
Plasm	-	-	-	-	-	-
Intestines m/head						
- small - medium - large - bladders - fat ends	9.4	124.1	-	-	-	124.1
Skins	18.0	237.6	-	-	237.6	-
Contents of stomachs and intestines	41.1	542.5	-	-	-	542.5
Total		1,786.2	153.8	123.0	237.6	1.272.0

5.12. GONDAR - Meat Factory (Slaughterhouse)

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5.12.01. General description

5.12.02. Store animal supply

5.12.03. Slaughter

5.12.04. Kind, quantity, and quality of by-products

5.12.05. Kind, quantity, and quality of used by-products, possibilities of quality increase

5.12.06. Kind, quantity, and quality of by-products not used at present

5.12.07. By-products treated in processing plants

5.12.08. Modification of slaughterhouse operations in favour of maximum by-product winning

5.12.09. Economic evaluation

Table:

5.12.-01 Review of by-products

5.12.01. General description

The Gondar Meat Factory is an enterprise of LIMCOR and was built on the present site outside the town of Gondar in 1970. Apart from a slaughtering plant for cattle the enterprise disposes of a canning line, a meat concentrate plant, and a by-product plant to produce meat and bone meal.
The enterprise is situated on a hilly ground with rocky subsoil.
Only State slaughters are done.
The maximum capacity amounts to 150 cattle per shift, the enterprise being run in one-shift operation. Capacities of canning and by-product departments are designed for the slaughtering quantity. Slaughtering is in seasons.
One slaughtering period is from September to June.
Production is for exportation as well as for the local market.

5.12.02. Store animal supply

Store animals are supplied from State farms as well as from livestock markets. Housing capacity amounts to 600 cattle. Animals are kept in a quarantine station for 24 hours and examined by a veterinarian. Diseased animals are separated and supplied to emergency slaughter. Male animals are supplied. The are driven to slaughter through restricted passage-ways. The fence causes injuries, and hide damages are not impossible.

5.12.03. Slaughter

The whole slaughtering plant shows a low degree of mechanization mainly with manual operations at a suspension conveyor with transport by hand. Chutes and pipelines are used for the transport of slaughtering by-products. Cold storage capacity for carcasses is not sufficient. Before they are put to cold storage the warm carcasses are hung for 3 - 4 hours after slaughter. This results in an increased loss by shrinkage which could be reduced by at least 1.5 % with appropriate refrigeration (interrupted fast cooling). There is a separate room for emergency slaughter.

5.12.04. Kind, quantity, and quality of by-products

Table 5.12.-01 shows a survey.
Quantity of obtained by-products totaled 1,656.0 t per year on an average during the last six years. In case of full use of all by-products with regard to the present conditions (animal keeping, animal hygiene, transport, etc) the following quantities could be used:

for human consumption	205.0 t
for industrial use	1,451.0 t.

Actually only the following quantities are used:

for human consumption	109.0 t
for industrial use	1,131.0 t.

The remaining 414.0 t are not used.

Essentially the applied slaughtering technology meets the requirements made on high-quality winning of by-products.

5.12.05. Kind, quantitiy, and quality of used by-products - possibilities of quality increase

By-products which are usable for human consumption are used for supply as prescribed by consumer's habits after removal of condemned slaughter (partially more than 90 %).
Quality of winning meets requirements. Usable by-products are:

- liver	- condemned slaughter rate 99 %
- kidneys	- condemned slaughter rate -
- heart	- condemned slaughter rate -
- paunch	- condemned slaughter rate -
- tongues	- condemned slaughter rate - as stated by the partner.

Spleens, lungs with throat, obtained during the slaughtering process as well as brain, blood, and spinal marrow are not used for human consumption. These parts are supplied to animal body meal production together with condemned organs, offals, lower legs, and horn.

There is no processing of intestines and glands during the slaughtering process. These products are supplied to the by-product department.
Neat hides are won and air-dried. Sales are irregular because hides are sold only to private traders. Bones, sinews, etc obtained from the cutting-up department are also supplied to the by-product processing plant.
Slaughterhouse operations allow better utilization of by-products (see modification suggestions).

5.12.06. Kind, quantity, and quality of by-products not used at present

By-products which are not used at present have to be taken from table 5.12.-01. The main part are contents of stomachs and intestines which would be suitable for composting as far as quality is concerned.
Gall and gallbladder peel as well as tail hair allow processing, too.

5.12.07. By-products treated in processing plants

For the site of Gondar it is characteristic that, after subtraction of fresh sale of organs nearly all by-products except manure are supplied to the processing plant.
Not in every case this use is the optimum processing variant to use these raw materials.

5.12.08. Modification of slaughterhouse operations in favour of maximum by-product winning

First of all maximum use for human consumption must have priority in by-product winning.

Blood: In blood winning a distinction has to be made between blood during killing and seeping blood. Blood during killing has to be collected in separate vessels and processed either directly or as blood plasm in sausage production and canning.

Brain and spinal marrow: The head has to be split, and brain as well as spinal marrow have to be removed from the carcass parts and supplied to sausage production and canning.

Lung with throat meat: Lung has to be separated from the windpipe. Throat meat has to be won in the cutting-up department, and both the products have to be supplied to sausage production.

Spleen: Spleen has to be supplied to sausage production and canning.

Intestines: Intestines have to be won at the point of supply to the by-product processing plant, treated, deslimed, and salted. Obtained intestines have to be used as sausage skins at home or provided for exportation. The necessary processing space has to be provided by roofing between the slaughterhall and the by-product processing plant. Transport of final products is by the existing ramps. Floor space requirements amount to about 50 m^2.

Glands: Have to be won during the slaughtering process, deep-frozen, stored, and supplied to pharmaceutical processing.

Cold storage house:

Based on the actual conditions at present there is an extremely high cooling loss caused by hanging of the warm carcasses after slaughter which can be reduced by at least 1.5 %.
For this purpose the whole cooling line has to be rebuilt.
The partner seems to have recognized this deficiency because there is already refrigerating equipment from FRG imports in the material stores. An exact specification of equipment and the planned size of the project could not be determined.
It would be possible to use the existing cutting-up room or parts of the slaughterhall as cooling places by respective structural modifications. After execution of these measures the existing cold storage chamber has to be used as moderate temperature room for the cutting-up department. In the same way space of the present administration tract could be used for production purposes which would result in an optimum technological course of the whole plant. Because refrigerating plants are already part of reconstruction measures this position is not considered in the reflections related to managerial economics.

Slaughtering capacity:

According to the figures delivered by the partner the existing slaughter capacity has been exploited only at one third during the last six years. A change of the situation is also not expected in the near future.
A City Slaughterhouse of the municipal authorities is situated in the centre of Gondar. There is no industrial processing of slaughtering by-products. In the interest of maximum utilization of these by-products it is recommended to supply 30 cattle and 40 sheep which have to be slaughtered there also to the Meat Factory. Overtaking of these slaughters should change nothing in subordination. Obtained by-products have to be bought up from the animal owner against payment.
Based on these suggestions the combination of the enterprises is subject of the calculation in the reflections related to managerial economics.

5.12.09. Economic evaluation

Investments

To put the modification suggestions into practice as described under item 5.12.08. the following investments are necessary:

	local currency	foreign currency
	birr	birr
a) Structural works	-	-
b) Technical equipment		
- for blood plasm winning		
1 centrifuge	-	12,000.-
2 storage tanks at 200 l each	-	3,200.-
10 plastic barrels at 100 l each	-	1,000.-
- for brain and spinal marrow winning	-	-
- spleen, lung, throat	-	-
- for gland and intestine winning		
1 desliming machine	-	40,000.-
5 worktables	2,500.-	-
5 sinks with hot-water supply	2,500.-	-
10 plastic barrels at 100 l each	-	1,000.-
2 freezer chests at 400 l each	-	8,000.-
- for cold storage house conveying equipment	-	50,000.-
	5,000.-	115,200.-
total	120,200.-	

Labour

for blood plasm winning	1 worker
for intestine winning and treatment	10 workers
for brain, spinal marrow, lung with throat	2 workers
for gland winning	2 workers
1 supervisor	1
	16 workers

Additional current costs

wages, salaries	11,700.- birr/a
maintenance, attendance, repair	14,420.- birr/a
depreciation	12,020.- birr/a
	38,140.- birr/a

Extra receipts

- blood plasm	51.0 t	17,850.- birr/a
- glands	5.8 t	29,000.- birr/a
- intestines	750,000 m	75,000.- birr/a
- organs for direct human consumption as indicated in the table	57.0 t	114,000.- birr/a
- red meat	16.5 t	66,000.- birr/a
		301,850.- birr/a

Cost-benefit-analysis

receipts:	301,850.- birr/a
costs:	38,140.- birr/a
proceeds:	263,770.- birr/a
profit = proceeds - funds payment	210,970.- birr/a

rate of return: $\frac{\text{investments}}{\text{profit}} = \frac{120{,}200.-}{210{,}970.-} =$ 0.55 years

Table No 5.12.-01

Review of by-products - GONDAR - Meat Factory

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Liver	3.0	30.0	0.3	-	29.7	-
Kidney	0.8	8.0	8.0	-	-	-
Spleen	0.7	7.0	-	7.0	7.0	-
Heart	1.0	10.0	10.0	-	-	-
Lung	3.4	34.0	-	17.0	34.0	-
Throat	0.3	3.4	-	1.7	3.4	-
Paunch Rumen Stomach	15.2	152.0	80.0	-	72.0	-
Head	12.0	120.0	-	-	120.0	-
Tongue	1.1	11.0	11.0	-	-	-
Brain	0.3	3.0	-	3.0	3.0	-
Mouth Mask	3.2	32.0	-	-	32.0	-
Udder	-	-	-	-	-	-
Spinal marrow	0.1	1.0	-	1.0	1.0	-
Pancreas	0.2	2.0	-	-	2.0	-
Suprarenal body	0.05	0.5	-	-	0.5	-
Gall	0.15	1.5	-	-	-	1.5
Gallbladder peel	0.05	0.5	-	-	-	0.5
Ear ends	0.05	0.5	-	-	0.5	-
Tail	0.1	1.0	-	-	-	1.0
Horn	0.5	5.0	-	-	5.0	-

Table No 5.12.-01

Review of by-products - GONDAR - Meat Factory

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Legs	6.1	61.0	-	-	61.0	-
Confiscates	8.5	85.0	-	-	85.0	-
Tallow	1.4	14.0	-	14.0	14.0	-
Fodder blood	3.4	34.0	-	-	34.0	-
Processing blood	5.2	52.0	-	52.0	52.0	-
Plasm	-	-	-	-	-	-
Intestines m/head - small - medium - large - bladders - fat ends	9.4	94.0	-	-	94.0	-
Skins	18.0	180.0	-	-	180.0	-
Contents of stomachs and intestines	41.1	411.0	-	-	(411.0)	-
Bones from the deboning section		300.0	-	-	300.0	-
Condemned animals		2.5	-	-	2.5	-
Total		1,655.9	109.3	95.7	1,132.6	3.0

5.13. GONDAR - City Slaughterhouse

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5.13.05. Modification of slaughterhouse operations in favour of maximum by-product processing

Tables:

5.13.-01 Review of by-products / cattle
5.13.-02 Review of by-products / sheep

5.13.01. General description

The Gondar City Slaughterhouse where exclusively service slaughters for butchers are done is managed by the local municipal authorities.
There are two separate slaughterhalls, one for Muslim and one for Christian slaughtering technology each. The latter is the major part of total slaughter with about 90 %.

Every year 8,000 cattle and 10,500 small animals are slaughtered.
The building of the slaughterhouse is worn out. There are no additional departments at all, none of the working rooms is tiled. Cold storage chambers are not available. Hot-water and steam generating plants do not exist. The slaughterhouse is run in one-shift operation. The date of visit the plant was not in operation.

5.13.02. Store animal supply

Store animals are supplied by the customers and inspected by a veterinarian.
Supply is in the afternoon. Animals are not weighed before slaughter.

5.13.03. Slaughter

Animals supplied for slaughter are slaughtered in the evening. The daily slaughtering output amounts to 30 cattle and 40 sheep. The slaughtering technology in both the departments is extremely primitive. There are no mechanized operations, the principle of nest work is applied.
Animals are slaughtered and skinned on the floor. A lift makes further treatment possible.
After slaughtering carcasses are roughly cut up. The applied slaughtering technology does not meet the present requirements made on correct raw material winning in any way, from aspects of technology as well as veterinary hygiene.

5.13.04. Kind, quantity, and quality of by-products

Kind and quantity of obtained by-products are shown in tables 5.13.-01 and 5.13.-02. The annual yield totals 1,247.0 t. From this quantity could be utilized

for human consumption	183.0 t
for industrial use	1,064.0 t.

Actually only the following quantities are used:

for human consumption	104.0 t
for industrial use	196.0 t.

This results in a deficit of 947.0 t which remains unprocessed at the moment.

In this slaughterhouse it is common practice that unprocessed products, condemned organs, offals, blood, etc are thrown into separate pits. These pits are not emptied and closed, if the level is reached. By-products won during the slaughtering process allow only limited processing for human consumption because of a high degree of contamination.

The above-mentioned figures were determined according to statements of the partner. Data concerning the expected slaughtering quality were derived from the actual conditions during the visit.

Detailed evaluation of quality of used and unused by-products was not made for the above-mentioned reasons.

5.13.05. Modification of slaughterhouse operations in favour of maximum by-product processing

To achieve optimum utilization of obtained by-products very extensive technological and structural modifications have to be made which would be equal to building a new slaughterhouse. Because the slaughterhouse of the Meat Factory is situated in the town it is recommended to carry out service slaughters in this enterprise. The existing buildings have to be used for the remaining Muslim slaughters.

By this change of organizational responsibility the deficit of 947.0 t of by-products could be utilized for human consumption as well as for industrial purposes by processing in the Meat Factory.

Based on this suggestion reflections related to managerial economics by use of by-products are already part of item 5.12.

Table No 5.13.-01

Review of by-products

GONDAR City Slaughterhouse

Animal: cattle

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	By-products for human consumption unused t/a	By-products for ind. purposes used t/a	By-products for ind. purposes unused t/a
Liver	3.0	24.0	0.2	–	–	23.8
Kidney	0.8	6.4	6.4	–	–	–
Spleen	0,7	5,6	–	5,6	–	–
Heart	1,0	8,0	8,0	–	–	–
Lung	3,4	27,2	–	13,6	–	13,6
Throat	0,3	2,4	–	1,2	–	1,2
Paunch) Rumen) Stomach)	15,2	121,6	64	–	–	57,6
Head	12,0	96,0	–	–	–	96,0
Tongue	1,1	8,8	8,8	–	–	–
Brain	0,3	2,4	–	2,4	–	–
Mouth) Mask)	3,2	25,6	–	–	25,6	–
Udder	–	–	–	–	–	–
Spinal Marrow	0,1	0,8	–	0,8	–	–
Pan-creas	0,2	1,6	–	–	–	1,6
Supra-renal body	0,05	0,4	–	–	–	0,4
Gall	0,15	1,2	–	–	–	1,2
Gall-bladder peel	0,05	0,4	–	–	–	0,4
Ear Ends	0,05	0,4	–	–	–	0,4
Tail	0,1	0,8	–	–	–	0,8
Horn	0,5	4,0	–	–	–	4,0

Table No 5.13.-01

Review of by-products

Gondar City Slaughterhouse

Animal: cattle

Kind of by-product	By-products per head kg	Byproducts per year t	By-products for human consumption used t/a	unused t/a	By-products for ind. purposes used t/a	unused t/a
Legs	6,1	48,8	-	-	-	48,8
Confiscates	8,5	68,0	-	-	-	68,0
Tallow	1,4	11,2	11,2	-	-	-
Fodder blood	3,4	27,2	-	-	-	27,2
Processing blood	5,2	41,6	-	41,6	-	-
Plasm	-	-				
Intestines m/head - small - medium - large - bladders - fat ends	9,4	75,2	-	-	-	75,2
Skins	18,0	144,0	-	-	144,0	-
contents of stomachs and intestines	41,1	328,8	-	-	-	328,8
total		1.082,4	98,6	65,2	169,6	749,0

Table No 5.13.-02

Review of by-products

GONDAR City Slaughterhouse

Animal: sheep

Kind of by-product	By-products per head kg	By-products per year t	By-products for human consumption used t/a	By-products for human consumption unused t/a	By-products for ind. purposes used t/a	By-products for ind. purposes unused t/a
Liver	0.5	5.3	2.7	-	-	2.6
Kidneys	0.1	1.1	1.0	-	-	0.1
Heart	0.1	1.1	0.9	-	-	0.2
Lung	0.4	4.2	-	2.5	-	1.7
Throat	0.1	1.1	-	0.7	-	0.4
Paunch, rumen and stomach	2.0	21.0	-	-	-	21.0
Head	1.6	16.8	-	-	-	16.8
Tongue	0.1	1.1	1.1	-	-	-
Brain	0.1	1.1	-	1.1	-	-
Mask	0.6	6.3	-	-	-	6.3
Udder	0.1	1.1	-	1.1	-	-
Gland Pancreas	0.035	0.4	-	-	-	0.4
Horn	0.04	0.4	-	-	-	0.4
Confiscate	1.35	14.2	-	-	-	14.2
Suet	-	-	-	-	-	-
Blood for fodder	1.2	12.6	-	-	-	12.6
Blood for processing	0.8	8.4	-	8.4	-	-
Fine intestine Blind gut	3.5	36.8	-	-	-	36.8
Skin	2.5	26.3	-	-	26.3	-
Lower legs	0.5	5.3	-	-	-	5.3
Total		164.5	5.7	13.8	26.3	118.8

CHAPTER 6

ANALYSIS OF BY-PRODUCT PROCESSING PLANTS

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6.01. Summary and general explanation

The visited by-product processing plants are local and organizational parts of the respective slaughterhouses.
In the interest of more strinking representation of specific features of the by-product processing plants as well as definition of appropriate suggestions for modifications these plants are described in this final draft report under item 6 apart from the other slaughterhouse operations.
For that reason economic evaluations are also made only for the respective by-product processing plants although the respective slaughterhouses and their by-product processing plants are an unit in reality as far as organization and economic are concerned.
Individual economic evaluations as well as assessments of chapter 5 are the basis for financial and economic evaluation (chapter 9).

In the interest of homogeneity of reflections and evaluation the plants of the Addis Ababa Meat Concentrate Factory and the Asmara Meat Processing Factory have been explained in chapter 6 as well with regard to the definition of the concept of "by-products" determined in chapter 3.
Economic evaluations were based on the same economic data, suppositions, and conditions which have already been explained under item 5.01. and applied for the assessment of slaughterhouses. For that reason a second description is not made.

6.02. ADDIS ABABA - City Slaughterhouse By-product Processing Plant

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6.02.01. General description

The by-product processing plant is housed in the slaughter-house building. It is situated on a lower level.
Chutes and channels are used for transportation.
The plant is run in two-shift operation with a capacity of 15,850 t per year. The general impression of the plant shows a high degree of wear, but the plant is in working order.
More attention has to be payed to preventive maintenance.

Specification of equipment	Capacity
4 bone crushers, 3 of them defective	unknown
1 blood autoclave	3 t capacity
2 autoclaves	at 3 t capacity each
2 autoclaves for gelatin	at 15 t capacity each
2 craneways	at 1 t load each
4 centrifuges	at 0.5 t capacity each
3 fat tanks	about 3 m^3 capacity
1 purification tank	about 5 m^3 capacity
3 mills, 2 of them defective	unknown
1 riddler	unknown
1 bagging device	unknown
1 balance	100 kg
divers conveying equipment, elevators, pipelines, and pumps	

6.02.02. Kind and quantity of by-products processed at present

Kind and quantity of by-products used for industrial purposes at present are shcwn in detail in table 5.02.-01. All condemned organs as well as all offals, blood, and tallow are supplied to animal body meal production immediately after slaughter. Lower legs are used for gelatin production in a separate plant. It is not possible to crush all hard bones obtained during slaughter and cutting-up with the existing plant.
Final products such as blood meal, bone and meat meal as well as horn meal are mixed together after grinding. Components of the final products are chemically tested.

6.02.03. Modification suggestions in favour of maximum by-product utilization

Taking the modification suggestions for slaughterhouse technology mentioned under 5.02. into account, the total yield for the by-product processing plant is reduced by about 2,400 t (blood, glands, intestines, organs) because glands, intestines, and blood are used elsewhere. For all-round use of all obtained bones an efficient bone crushing plant has to be installed, or the existing three defective bone crushers have to be repaired. Necessary spare parts have to be ordered from the producer or drawings of piece parts for copying.
By these measures 1,570 t of raw material (bones) could be processed in addition.

6.02.04. Economic evaluation

Investments

	local currency	foreign currency
	birr	birr
1 bone crusher 2 t/h	-	50,000.-

Labour

no additional workers

Additional current costs

wages	-	-
repair of all bone crushers	-	15,000.-
maintenance, attendance	-	6,000.-
		21,000.-

Extra proceeds

Receipts are reduced by using blood, glands, intestines, and organs for human consumption as follows:

2,400 t fresh material = 480 t meal =	240,000.-	birr/a
Extra proceeds result from 1,570 t bone processing = 314 t meal =	157,000.-	birr/a
reduction:	83,000.-	birr/a

Cost-benefit-analysis

	slaughterhouse (birr/a)	by-product processing plant (birr/a)	total (birr/a)
extra receipts	1,941,000.-	- 83,000.-	1,858,000.-
extra costs	38,500.-	21,000.-	59,500.-
extra proceeds			1,798,500.-

profit: extra proceeds - funds payment (20 %) 1,438,800.-

rate of return: $\frac{\text{investments}}{\text{profit}}$ = 0.07 years

Please note:

In the modification suggestions under item 6.02.03. intentionally no proposals for technical renewing of highly worn-out equipment were made because there are already studies (CSSE and FAO) concerning the construction of a new slaughterhouse for 1,400 - 2,000 cattle/d, 1,000 goats/sheep per day, and 500 pigs per day including by-product processing plant, and financial resources should be concentrated on this new slaughterhouse.

The modification suggestions of item 6.02.03. are at the same time the basis for gradually reduction of stocks of old bones estimated at about 170,000 tons which are stored immediately beside the slaughterhouse grounds and cause an extremely high environmental pollution viewed from aspects of hygiene.

6.03. ADDIS ABABA - Meat Concentrate

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6.03 Proposal for new recipe of Mortadella

6.03.01. General description

The Addis Ababa Meat Concentrate is subordinate to LIMCOR.
The enterprise is situated in the outskirts of the capital.
The range of production comprises fresh meats and sausages as well as canned meat and vegetables for the home market and partially for exportation.
Per day 30 sides of pork are cut up and processed in this enterprise. Beef in supplied as deboned meat.
Meat is supplied from Debre Zeyt and the Addis Ababa City Slaughterhouse.
The enterprise's grounds allow essential extention and enlargement of structural works.
Nevertheless, it must be considered that high expenditure of development work would be necessary because of unevenness of the site.
There is enough technical equipment in the enterprise in good conditions reaching from delivery up to dispatch of final products, so that processing capacity could be essentially increased. At present estimate the actual extent of capacity utilization is about 30 %.
Internal transport is mainly manual.

6.03.02. Kind, quantity of by-products processed at present

Production of sausages and hams as well as canned products is based on order by customers (hotels, restaurants, embassies).
There is no storage and stockpiling of fresh sausages.
Only raw material coming up to own standards is supplied to sausage production and canning.
By-products from slaughter and cutting-up are not used.
Use of small intestines of sheep for "frankfurters" is an exception. The insufficient utilization of organs, rinds, and blood plasm in the production range is asolutely unsatisfactory.
For the production of other sausages only artificial sausage skins are used.

6.03.03. Modification suggestions in favour of maximum by-product utilization

For maximum utilization of by-products from slaughter and cutting-up it is recommended to restructure the present range of products. The kinds of sausages of the new production range are listed in annex 2. Strict use of natural sausage skins has to be taken into account.

6.03.04. Economic evaluation

The suggested change of the range of products does not require any additional investments or labour.
Extra receipts in the enterprise are obtained by economical use of raw materials (up to now 100 % use of meat for sausage production, in future 85 % use of meat and 15 % use of by-products in the form of blood, heart, kidney, liver, lung).
By addition of blood plasm instead of water output of final products can be increased up to 120 % in case of boiling sausages.

Additional costs result from buying-up of by-products such as
- blood plasm
- intestines
- diverse organs.

Foreign currency is saved by utilization of intestines obtained at home. According to rough calculations which cannot be proved by figures for reasons of lacking information modification of the product range has a positive influence on production results.
To illustrate the use of by-products and explain the economic results which can be obtained by their utilization an example is given in this connection on the basis for comparison of 100 kg: in table 6.03.

Table 6.03

Proposal for new recipe of Mortadella

used material	previous recipe		new recipe	
kind of meat	kg	costs (birr)	kg	costs (birr)
beef meat	25	125.-	35	175.-
pork meat	75	375.-	52	260.-
heart	-	-	10	20.-
pig skin	-	-	3	-
	100	500.-	100	455.-
additive (plasm)	-	-	30	9.-
spices + salt	8.25	57.-	8.85	57.-
filling	108.85	557.-	138.85	521.-
sausage skin requirements	21 m (import)	2.10	26 m (local)	2.60
final weight				
final product after cooking (selling weight)	92.85	559.10	122.85	523.60
material costs	6.02 birr/kg		4.26 birr/kg	
extra yield	122.85 kg - 92.85 kg	=	30.00 kg	
cost difference for 100 kg:	- 176.- birr			

In case of a production volume of about 32.7 t/a of the enterprise extra proceed of 57,552.- birr/a are obtained with a material cost difference of 176 birr/100 kg or 1,760 birr/t.

6.04. MALGE WONDO - ELIDCO Meat Factory By-product Processing Plant

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6.04. MALGE WONDO - ELIDCO Meat Factory By-product processing plant

6.04.01. General description

The by-product processing plant is immediately adjacent to the slaughterhouse and installed in the same building.
There is a separation for reasons of epizootics hygiene.
The plant runs in three shifts with a capacity of 20 t of raw material per day. As far as equipment is concerned the plant is outfitted with all necessary machines and devices, but shows a relatively high degree of wear.
Specification of equipment:

2 bone crushers
3 autoclaves, comprising 1 autoclave for blood meal production (defective)
1 craneway
2 centrifuges
2 fat containers
1 purification basin
1 mill
1 riddler
1 bagging device
1 cleaning drum with preceding mill (defective)
and diverse worktables and chutes.

There is enough capacity for the consumption of technical media.
Meal products sold at present are mostly supplied to exportation.

6.04.02. Kind and quantity of by-products processed at present

The plant processes 4,994 t per year. This is the sum of products of industrial use listed in table No. 5.05.-01 less hides. The total sum comprises all condemned organs, including all obtained glands, intestines, confiscates, and lower legs.
Furthermore this sum includes the 1303.0 t of bones from the cutting-up department.
These products are prepared, after previous cleaning and crushing, in the respective treatment stage. In the processing plant meat and bone meal are mixed in the ratio of 3 : 2.
The final product is tested chemically and, after that, released for sale.
The obtained processing fat is barrelled after purification.

6.04.03. Modification suggestions in favour of maximum by-product processing

Taking the modifications already suggested under item 5.05., such as the use of glands, paunch, intestines, brain, etc, into account, obtained by-products amount to 3467.0 t based on the same annual slaughtering quantity.

Blood: Utilization of blood of industrial use requires the repair of the existing blood processing plant (standstill for 15 years). The required spare parts have to be ordered from the respective manufacturing firm or, if necessary, component part drawings for local fabrication of spare parts in Ethiopia. This results in an additional processing of 264.0 t of blood per year.

Horn material: Horn material is heat-treated after slaughter and has to be used for horn meal production by passing a bone crusher and, if necessary, separate boiling, or added to animal body meal. The annual quantity amounts to 33.0 t.

Masks and
tail residues: These parts have to be added to the usual material. The annual yield of masks would amount to 211.0 t and, of ear ends and tail residues, to 9.4 t. This results in an use of 3,985 t per year.

6.04.04. Economic evaluation

To put the modifications suggested under item 6.04.03. into practice no additional investments are necessary. But it is recommended to replace outdated and partially worn-out equipment systematically by new machines. This measure is not part of this study.

Labour

Modification of the present staff is not necessary.

Additional current costs

Because of the use of by-products for processing reduced by about 1,000 t/a current annual costs for water, steam, electric power, and wages are diminished by 5 - 10 %.

Extra receipts

Profits from selling bone and meat meal diminish b ythe amount of about 125,000.- birr/a.
(about 250 t/a at 500.- birr/t each)

Cost-benefit-analysis

In the interest of economic evaluation of the entire enterprise extra gains from modification of the slaughterhouse are compared with reduced receipts of the by-product processing plant.

	slaughterhouse (birr/a)	by-product processing plant (birr/a)	altogether (birr/a)
receipts	1,367,900.-	./. 125,000.-	1,242,900.-
costs	30,700.-	-	30,700.-
			1,212,200.-

profit: proceeds - funds payment (20 %)

1,212,200.- - 242,440.- = 969,760.- birr/a

By carrying out these measures suggested in favour of higher use of by-products for human consumption additional annual gain 969,760.- birr may be made with low investments of 84,200.- birr.

6.05. ASMARA - SOPRAL By-product Processing Plant

As described under item 5.06. three-shift operation of the by-product processing plant would be possible.
From the point of view of the technological and technical state the plant is in working order. As stated by the partner obtained by-products for animal meal production were processed in one shift in case of continuous slaughtering.
Quantity and quality cannot be evaluated with regard to item 5.06.

6.06. ASMARA - Canning Meat Factory

The SOPRAL Canning Meat Factory is a canning enterprise which subordinate to LIMCOR.

The enterprise disposes of relatively modern canning technology. Equipment is comprehensive and would allow also production of canned meat.

The partner was not able to indicate the overall processing capacity. The machinery would allow a daily output of 8 - 10 t.

At present the range of production comprises only home-grown canned vegetables, soups, and bean dishes for exportation.

There is no processing of by-products from the meat sector.

For that reason further assessments of the by-product processing plant and the use of by-products do not apply.

6.07. ASMARA - INCODE By-product Processing Plant

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6.07.04. Economic evaluation

6.07.01. General description

The by-product processing plant is adjacent to the slaughterhouse and works in one-shift operation.
In case of three-shift operation daily processing capacity amounts to 18 t.
At present all organs including condemned organs except blood are processed to animal body meal.
The plant is out of operation during several months just as the slaughterhouse.
Because of the sevenfold increase of the oil price blood meal production has been abandoned.
The plant was in relatively good conditions and seems to be regular maintained. Except the blood autoclave all machines and parts were in working order.

Specification of equipment

1 bone bioler		1.2	t/h
2 autoclaves at	a	1.5	t each
1 blood autoclave at	a	1000	l
2 craneways at		500	kg
1 fat centrifuge at	a	500	kg
2 fat containers at	a	1500	l each

1 mill
1 riddler
1 meal reservoir
1 bagging scale
diverse chutes, worktables, and elevators

Steam generation for the whole plant is by an inefficient generating plant (as stated by the partner). At the time of visit this plant was out of operation.

6.07.02. Kind and quantity of by-products processed at present

Kind and quantity of by-products which are processed to animal body meal at present are shown in table 5.07.-01.
These products are supplied immediately after slaughter so that fresh processing is guarantied.
In case of the actual slaughter quantity the plant is only utilized to 40 % which is also the reason for one-shift operation.

6.07.03. Modification suggestions in favour of maximum by-product utilization

As already described under item 5.07. and 5.08. the total yield of raw material from the combination of the INCODE Slaughterhouse and the City Slaughterhouse can be processed in the by-product processing plant.
If required the plant has to be run in two- or three-shift operationduring peak periods.
In case of maximum by-product winning for human consumption raw material obtained for the processing plant is diminished by 108 t.

6.07.04. Economic evaluation

Receipts from selling animal body meal diminish by the amount of 67,875.- birr/a because 137 t of animal body meal less are obtained in the State sector (own slaughter of INCODE) by the increase of use of by-products for human consumption.
Additional costs result from purchasing of by-products from service slaughters of 21,750.- birr/a which have to be done in future (433 t of purchased by-products).
Extra receipts result from by-products of service slaughter and amount to 54,500.- birr/a.

Cost-benefit-analysis

In the interest of economic evaluation of the whole enterprise extra gain from modification of the slaughterhouse (see item 5.07.09.) is compared with reduced receipts of the by-product processing plant.

	slaughterhouse (birr/a)	by-product processing plant (birr/a)	total (birr/a)
receipts	1,114,180.-	./. 13,380.-	1,100,800.-
costs	88,100.-	21,700.-	109,800.-
proceeds:			991,000.-

profit: proceeds - funds payment 792,800.-

rate of return: $\frac{\text{investments}}{\text{profit}} = \frac{315{,}000.-}{792{,}763.-} =$ 0.40 years

6.08. ASMARA - Meat Processing Factory

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6.08.02. Kind and quantity of by-products processed at present

6.08.03. Modification suggestions in favour of maximum by-product utilization

6.08.04. Economic evaluation

6.08.01. General description

The Asmara Meat Processing Factory ist a part of the agro-industrial complex Kehren-Asmara and subdivided into three main sectors. The meat processing sector is subject of this reflections.
The Meat Processing Factory is an enterprise which obtains the raw material of meat from ordered slaughters of the City Slaughterhouse and the own State farm at Kehren.
Pork is supplied as carcasses, and cut up and prepared as required by the product plan of sausage production.
The range of production is enclosed in annex 1.
Five pigs are cut up and processed per day on an average with a possible capacity of 10 pigs. The meat of one cattle is processed per day.
The mechanical equipment is oversized for this capacity.
There are:

2 mincers
1 sausage mincer
1 sausage filler
1 mixer
1 smoking plant
diverse cold storage chambers and side rooms
1 ripening chamber for raw sausages and hams

Technological linkage bet n the departments is not the best possible. Internal trans is mostly manual.

6.08.02. Kind and quantity of by-products processed at present

Sausages and hams are produced on the basis of customer orders (hotels).
There is no storage and stockpiling. Only raw material coming up to own standards is supplied to sausage production. By-products from slaughter and cutting up are not used.

Use of organs, rinds, and blood plasm in the range of production is absolutely unsatisfactory.
In sausage production only artificial sausage skins (imports) are used.

6.08.03. Modification suggestions in favour of maximum by-product utilization

For maximum processing of by-products from slaughter and cutting up it is recommended to extend the range of products.
Kinds of the new production range are listed in annex 2.
It is aimed at maximum use of natural sausage skins.

6.08.04. Economic evaluation

Better economic results could be reached by consideration of the recommendations mentioned under item 6.03.04. already.

6.09. KOMBOLCHA - Meat Factory By-product Processing Plant

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6.09 04. Economic evaluation

6.09.01. General description

The by-product processing plant is directly adjacent to the slaughterhouse and situated in the same building.
There is a very good technological linkage between raw material production and reception of goods from slaughtering process as well as from separate emergency slaughter.
The plant is run in three-shift operation with the capacity obtained from slaughter. With the present slaughtering output of 75 cattle per day on an average the plant is utilized to only one third.
The plant is fitted out with the following equipment:

1 bone crusher
1 blood collecting boiler with direct steam heating
2 autoclaves at 5,000 kg each
1 craneway
1 centrifuge (fat) 500 kg
2 fat containers at 2,000 l each
1 purification tank 1,000 l
1 mill
1 riddler
1 bagging device
1 cutting device for intestines
1 cleaning drum
diverse worktables and chutes

The average age of the plant is about 20 years. As stated by the partner all machines and devices were in working order, but require high expenditure of maintenance and attendance.

6.09.02. Kind and quantity of by-products processed at present

All condemned organs, confiscates, heads, and precleaned intestines including masks and glands are supplied to processing.
Supplied raw material totals 2,637.0 t/a for the actual slaughtering quantity.

6.09.03. Modification suggestions in favour of maximum by-product utilization

As already described in chapter 5.09. a lot of by-products used at present have to be supplied to human consumption.
Furthermore higher profits can be gained for the whole enterprise by winning of blood, intestines, and glands.
Taking these aspects into account the raw material supply is diminished by 332.0 t/a with the above-mentioned slaughtering quantity which inevitable results in a reduction of the animal body meal yield by 83.0 t/a.

6.09.04. Economic evaluation

Proceeds from selling animal body meal diminish by the amount of 41,500.- birr/a because 83 t of animal body meal less are obtained per year by increase of supply of by-products for human consumption.

Cost-benefit-analysis

In the interest of economic evaluation of the whole enterprise extra gain from modification of the slaughterhouse is compared with reduced receipts of the by-product processing plant.

	Slaughterhouse (birr/a)		By-product Processing Plant (birr/a)	Total (birr/a)
receipts	279,400.-	./.	41,500.-	237,900.-
costs	21,500.-		-	21,500.-
proceeds				216,400.-
profit: proceeds - funds payment				173,000.-

By putting the measures suggested in favour of increased use of by-products for human consumption into practice an annual extra profit of 173,000.- birr/a can be achieved with the single capital expenditure of 64,700.- birr (see item 5.09.08.).

6.10. GONDAR - Meat Factory By-product Processing Plant

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6.10.04. Economic evaluation

6.10.01. General description

The by-product processing plant is structurally separated from the other parts of the Meat Factory. The by-product processing plant can be reached by a passage way of about 6 m in width. Raw material supply is by chutes and pipelines. Bones and condemned carcasses are supplied with transport carts.
The plant is run in one-shift operation with a maximum capacity of 10 t. On this basis the by-product processing plant can process the by-products of the slaughtering process of about 150 cattle per day. The plant has been in operation since 1979 and shows a good state of maintenance.
The following equipment is available:

1 bone crusher type SR 20, year of construction 1980, 5 t/h
2 autoclaves at 2,000 kg each
1 blood autoclave at 1,000 kg - out of operation
1 fat centrifuge at 650 kg
2 fat setting basin at 0.7 m^3 with conical bottom and cleaning conduit
1 craneway 1,000 kg - electric
1 balance max. 1,000 kg
1 mill)
1 bone crusher) type and output unknown
)
1 riddler - own construction

There is enough capacity for technical utilities. A new steam generating plant on oil basis has been installed.

6.10.02. Kind and quantity of by-products processed at present

Products processed to animal body meal at present are shown in table 5.12.-01. In case of the actual slaughtering quantity 953.0 t/a of raw material are obtained for this department.
In the department horn material is completely processed. It is crushed and boiled in the autoclave for several hours together with the tallow.
After this fat is separated and the pretreated horn material is ground to horn meal in the mill.

6.10.03. Modification suggestions in favour of maximum by-product utilization

Based on the modification suggestions for the slaughtering technology raw material supply will be reduced from 953.0 t/a at present to 775.0 t/a in case of other industrial utilization (blood, glands, intestines). Furthermore it has been recommended under item 5.12. to combine the existing slaughter capacities at Gondar.
This would increase overall raw material yield by 460.0 t/a to 1,235.0 t/a. The additional yield of 460.0 t/a from service slaughter has to be bought from the animal owners against payment.

6.10.04. Economic evaluation

Development of raw material yield after modification:

	before	after modification
- raw material yield from the State sector	953 t	775 t
- yield from service slaughters	-	460 t
- yield of animal body meal	238 t	309 t

Although profits from selling animal body meal are reduced by 22,250.- birr/a for yields from the State sector caused by increase of use of by-products for human consumption total profits are raised by 35,500.- birr/a by purchasing and processing of by-products from service slaughters.

Cost-benefit-analysis

additional receipts	35,500.- birr/a
additional costs	23,000.- birr/a
proceeds	12,500.- birr/a

For slaughterhouse and by-product processing plant together:

	Slaughterhouse (birr/a)	By-product processing plant (birr/a)	total (birr/a)
receipts	301,850.-	35,500.-	337,350.-
costs	38,144.-	23,000.-	61,144.-
proceeds			276,206.-
profit: proceeds - funds payment =			220,965.-

CHAPTER 7

SUMMARY OF MODIFICATION POSSIBILITIES IN EXISTING SLAUGHTERHOUSES

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7.01. General explanation

Table

7.01

7.01. General explanation

Table 7.01 shows a short summary of the modification possibilities for the different slaughterhouse described in detail in chapter 5.

Gained extra profits are represented for the slaughterhouses with regard to the modification suggestions for existing by-product processing plants. This corresponds to the present accountancy of these enterprises. In case of consequent putting in practice of all modification suggestions altogether 5.40 million birr of extra profits could be obtained per year with the capital expenditure of altogether 0.80 million birr comprising 0.077 million birr in local currency and 0.72 million birr in foreign currency (based on US $).

Table 7. 01

Plant	Measure	Main equipment	Investment costs local currency (birr)	Investment costs foreign currency (birr)	Additional labour	Extra profit (Mio birr/a)
5.02. ADDIS ABABA City Slaughter-house	blood and plasm winning additional winning of organs gland winning for pharm. industry (export) intestine winning for home and exportation composted manure	centrifuge cold storage cell trailer for manure	4,700.-	42,000.-	42	1.44
5.03. Satellite Slaughterhouses	sale of by-products to the central processing plant	container	-	-	-	0.92
5.04. DEBRE ZEYT Slaughterhouse	blood and plasm winning additional winning of organs composted manure glandwinning for pharm. industry (export) intestine winning for home and exportation supply of by-products to the new processing plant improvement of hide quality	centrifuge skinning device	20,500.-	23,500.-	3	0.53

Table 7.01

Plant	Measure	Main equipment	Investment costs local currency (birr)	Investment costs foreign currency (birr)	Additional labour	Extra profit (Mio birr/a)
5.05. MALGE WONDO ELIDCO Meat Factory	blood and plasm winning additional winning of organs composted manure gland winning for pharm. industry intestine winning for home and exportation stomach meat winning	centrifuge desliming machine paunch scraping machine	7,200.-	77,000.-	20	0.92
5.06. ASMARA SOPRAL Meat Factory	not applicable (standstill)					
5.07. ASMARA INCODE Slaughter- house	blood and plasm winning gland winning for pharm. industry intestine winning for home and exportation improvement of hide quality composted manure reduction of shrinkage during cooling process winning of organs for human consumption takeover of the production of the City Slaughterhouse	centrifuge freezer chests desliming machine skinning device cooling tunnel	21,700.-	294,000.-	28	0.79

Table 7.01

Plant	Measure	Main equipment	Investment costs local currency (birr)	Investment costs foreign currency (birr)	Additional labour	Extra profit (Mio birr/a)
5.08. ASMARA City Slaughterhouse	not applicable because of combination with INCODE					
5.09. KOMBOLCHA SOPRAL Slaughterhouse	blood and plasm winning additional winning of organs intestine winning for home and exportation gland winning for pharm. industry	centrifuge desliming machine freezer chests	8,200.-	56,500.-	11	0.17
5.10. DIRE DAWA Meat Factory	blood and plasm winning additional winning of organs intestine winning for home and exportation gland winning for pharm. industry composted manure takeover of the production of the City Slaughterhouse	centrifuge desliming machine freezer chests	10,200.-	68,000.-	26	0.36

Table 7.01

Plant	Measure	Main equipment	Investment costs local currency (birr)	Investment costs foreign currency (birr)	Additional labour	Extra profit (Mio birr/a)
5.11. DIRE DAWA City Slaughterhouse	not applicable because of combination with the Dire Dawa Meat Factory					
5.12. GONDAR Meat Factory	blood and plasm winning additional winning of organs gland winning for pharm. industry intestine winning for home and exportation reduction of shrinkage in the cooling process	centrifuge freezer chests desliming machine extention of cooling space with conveying equipment	5,000.-	115,200.-	16	0.22
5.13. GONDAR City Slaughterhouse	not applicable because of combination with the Gondar Meat Factory					
		total	77,500.-	638,400.-	146	5.40

CHAPTER 8

SUMMARY OF MODIFICATION POSSIBILITIES AT EXISTING BY PRODUCT PROCESSING PLANTS

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8.01. General explanation

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8.01

8.01. General explanation

Just as for the slaughterhouses a summary of modification suggestions for existing by-product processing plants is given in chapter 8. Taking bookkeeping in the slaughterhouses which dispose already of a by-product processing plant into account economic results are considered altogether under item 7.

Table 8.01

Plant	Measure	Main equipment	Investment costs local currency (birr)	Investment costs foreign currency (birr)	Additional labour	Extra profit (Mio birr/a)
6.02. ADDIS ABABA City Slaughterhouse By-product Processing Plant	winning of more bone meal	bone crusher	-	50,000.-	-	
6.03. ADDIS ABABA Meat Concentrate Factory	extention of the range of products by use of by-products in sausage production and canning	-	-	-	-	
6.04. MALGE WONDO ELIDCO Meat Factory By-product Processing Plant	blood meal winning, animal body meal winning (treatment of empty horns)	repair of the blood boiler or processing as described in chapter 5.10.	-	-	-	
6.05. ASMARA SOPRAL By-product Processing Plant	not applicable (standstill)					

Table 8.01

Plant	Measure	Main equipment	Investment costs local currency (birr)	Investment costs foreign currency (birr)	Additional labour	Extra profit (Mio birr/a)
6.06. ASMARA SOPRAL Canned Meat Factory	extention of the range of products by use of by-products in sausage production and canning	-	-	-	-	
6.07. ASMARA INCODE By-product Processing Plant	no modification of technology takeover of by-product production from the City Slaughter-house	-	-	-	-	
6.08. ASMARA Meat Processing Factory	no modification of technology	-	-	-	-	
6.09. KOMBOLCHA SOPRAL Meat Factory By-product Processing Plant	extention of the range of products for the use of by-products in sausage production and canning	-	-	-	-	
6.10. GONDAR Meat Factory By-product Processing Plant	additional winning of animal body meal by takeover of the production from the City Slaughterhouse	-	-	-	-	
		total		50,000.-		

CHAPTER 9

FINANCIAL AND ECONOMIC EVALUATION

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9.01. Total yield of slaughterhouse by-products

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9.01. Total yield of slaughterhouse by-products

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9.01.01. Slaughterhouse by-products for human consumption

9.01.02. Industrial utilization of slaughterhouse by-products

9.01. Total yield of slaughterhouse by-products

Possible total yield of slaughterhouse by-products of the investigated plants amounts to 84,982 t per year (see table 9.01).

9.01.01. Slaughterhouse by-products for human consumption

Possible annual yield of slaughterhouse by-products for human consumption amounts to 12,089 t. Actually only 7,801 t are used. The difference between possible and actual use is 4,288 t. In slaughterhouses disposing of a by-product processing plant by-products are industrially processed. In slaughterhouses without by-product processing plant by-products are either removed or given to employees of the enterprise for human consumption or as dog food. By putting the modification suggestions into practice in the existing slaughterhouses and by-product processing plants, these 4,288 t could be completely supplied to direct human consumption with the single capital expenditure of 803,700.- birr.

9.01.02. Industrial utilization of slaughterhouse by-products

Possible yield of by-products for industrial use amounts to 72,893 t at the investigated plants. Actually only 48,944 t are used. The difference of 23,949 t is removed. These 23,949 t could immediately be processed to

4,660 t/a of animal body meal
200,000 m/a of sausage skins
1,770 t/a of industrial grease
2,820 t/a of fertilizers.

After putting of all of the project suggestions into practice, the yield of finished by-products would increase to 13,900 t/a of animal body meal
29,270,000 m/a of sausage skins
300 t/a of glands
5,450 t/a of industrial grease
2,820 t/a of compost
20,000 t/a of organic fertilizer

In case of exportation of intestines, glands, and bone and animal meal after putting into practice of the suggestions export proceeds of US $ 3.1 million could be obtained per year.

Export proceeds are subdivided into

US $ 1,12 million for intestines
US $ 0.5 - 0.7 million for glands
US $ 1.5 million for bone meal.

With the single capital expenditure of 803,700.- birr for modifications specified under item 9.01.01. plus a single capital expenditure for new buildings of 19,000,000 birr possible annual by-products of 72,893 t (see table 9.01) and 15,000 t of bones (bone pile Addis Ababa City Slaughterhouse) could be industrially processed obtaining quantity processed per year of 87,893 t.
Because the single capital expenditure for setting up a Central Slaughterhouse at Addis Ababa was not known at the time of investigation this sum could not be included in the calculation (see table 9.03).

9.02. Financial and economic overall accounting

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9.02.01. Modifications

9.02.02. Setting-up of new by-product processing plants

9.02.01. Modifications

Cost-benefit analysis for modifications of slaughterhouses and existing by-product processing plants shows a positive financial balance (see table 9.02).
An annual profit of about 4,485,000.- birr is obtained.
In the efficiency evaluation it has to be taken into account that the economic evaluations were made together for modifications of slaughterhouses and existing by-product processing plants.

9.02.02. Setting-up of new by-product processing plants

Cost-benefit analysis results in a negative balance (see table 9.03).
The reasons for this negative financial result are shown in chapter 10, in particular under item 10.04.04 and 10.05.04.
From aspects of nutritional policy as well as for reasons of replacement or of gain foreign currency annual supports (loss compensation) and additional funds payment by the State to achieve profitability of the enterprises are economically justified.
Besides these economic evaluations the aspect of improvement of all hygienic conditions for environment and workers at the plants by setting up new processing plants has to be fully considered.

Table 9.01

Quantity of slaughterhouse by-products after modification

Enterprise		For human consumption		For industrial use	
		possible yield (t/a)	actual use (t/a)	possible winning (t/a)	actual use (t/a)
5.02.	ADDIS ABABA City Slaughterhouse	3,431	2,495	24,783	15,270
5.03.	ADDIS ABABA Satellite Slaughter-houses	4,031	3,476	20,729	17,253
5.04.	DEBRE ZEYT Slaughterhouse	279	5	2,996	461
5.05.	MALGE WONDO ELIDCO Meat Factory	2,053	517	9,196	6,934
5.06.	ASMARA SOPRAL Meat Factory	-	-	-	-
5.07.	ASMARA INCODE Slaughterhouse	425	-	2,834	2,381
5.08.	ASMARA City Slaughterhouse	405	505	2,429	786
5.09.	KOMBOLCHA SOPRAL Slaughterhouse	463	239	3,531	3,803
5.10.	DIRE DAWA Meat Factory	337	197	2,368	494

Table 9.01

Quantity of slaughterhouse by-products after modification

Enterprise	For human consumption		For industrial use	
	possible yield (t/a)	actual use (t/a)	possible winning (t/a)	actual use (t/a)
5.11. DIRE DAWA City Slaughterhouse	277	154	1,462	238
5.12. GONDAR Meat Factory	205	109	1,45[illegible]	1,128
5.13. GONDAR City Slaughterhouse	183	104	1,064	196
	12,089	7,801	72,893	48,944

Table 9.02

Economic indices of modification suggestions for slaughterhouses

Enterprise	Receipts (birr)	Costs (birr)	Proceeds (birr)	Profit (birr)
5.02. / 6.02.	1,858,000.-	59,500.-	1,798,500.-	1,438,800.-
5.03.	-	-	-	918,450.-
5.04.	668,750.-	7,500.-	661,250.-	529,000.-
5.05. / 6.04.	1,242,900.-	30,700.-	1,212,200.-	969,760.-
5.06.	-	-	-	-
5.07. / 6.07.	1,100,805.-	109,851.-	990,954.-	792,763.-
5.08.	-	-	-	-
5.09. / 6.09.	237,900.-	21,494.-	216,406.-	173,125.-
5.10.	481,550.-	30,524.-	451,026.-	360,821.-
5.11.	-	-	-	-
5.12. / 6.10.	337,350.-	61,144.-	276,206.-	220,965.-
5.13.	-	-	-	-
	5,927,255.-	320,713.-	5,606,542.-	5,403,684.-

Table 9.03

Economic indices for setting-up of new by-product processing plants

Enterprise	Slaughterhouse by-products for industrial use (t)	Investments (birr)	Labour (number)	Costs (birr/a)	Proceeds (birr/a)	Profit (birr/a)	Rate of return (years)
9.02. ADDIS ABABA Central Slaughterhouse *1	-	-	-	-	-	-	-
9.03. ADDIS ABABA*1 Central By-Product Processing Plant	50,000.*2	15,000,000.-	-	-	-	-	-
9.04. DEBRE ZEYT By-Product Processing Plant	5,000	2,829,400.-	49	622,500.-	1,050,000.-	- 427,500.-	-
9.05. DIRE DAWA Meat Factory By-Product Processing Plant	2,000	1,218,400.-	28	250,000.-	268,997.-	- 18,997.-	-

*1 without economic evaluation because of lack of documents

*2 This yield is obtained, if no Central Slaughterhouse, but only a Central By-product Processing Plant is set up.

CHAPTER 10

SUGGESTIONS FOR NEW PLANTS

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10.01. General explanation

10.02. ADDIS ABABA - Central Slaughterhouse

10.03. ADDIS ABABA - Central By-product Processing Plant

10.04. DEBRE ZEYT - By-product Processing Plant

10.05. DIRE DAWA - Meat Factory By-product Processing Plant

10.01. General explanation

Analysis of the results of field work leads to the conclusion that besides of modification of existing slaughterhouses and by-product processing plants setting up of new by-product processing plants is recommended for the sites of Addis Ababa, Debre Zeyt, and Dire Dawa. The new production capacities obtained allow increase of feeding stuff production especially for poultry and cattle farms on the basis of home-grown raw materials which are not used up to now. At the same time additional export possibilities are opened up in future.

The project suggestions made in the following comprise, as required by the character of this report, only basic information and rough economic calculations. If LIMCOR takes putting into practice of these suggestions into consideration it is necessary to elaborate feasibility studies on this projects.

10.02. ADDIS ABABA - Central Slaughterhouse

The known situation in and around the present City Slaughterhouse of Addis Ababa which is briefly described in chapter 5.02. induced to the responsible authorities to draw the conclusion to set up a new central slaughterhouse for Addis Ababa.
Respective studies have already been ordered or elaborated by foreign firms. The FAO has drawn up a report related to the project as well in March 1985.
A basic decision on the project has not yet been made. Site, capacity, characteristics of technology, size of the by-product processing plant, and other things have not yet been determined.
A deliberation held in the office of the National Committee for Central Planning has shown that the problems of the City Slaughterhouse are known, but the document could not yet be integrated into the current 10-year plan.
This report has not the task to formulate the technical objective for the central slaughterhouse.
Nevertheless setting up as soon as possible of a new central slaughterhouse should be given more priority. Setting up of a central slaughterhouse including by-product processing plant has priority over the construction of a separate central by-product processing plant in any case.
Because setting up of a central slaughterhouse is not probable in the near future alternatively a central by-product processing plant is recommended as described under item 10.03.
If the central slaughterhouse is set up with the planned capacity of

1,500 cattle/d
1,000 sheep and goats/d
500 pigs/d,

the following quantity of slaughtering by-products is obtained per year:

for industrial use:

- for animal body meal production

48 kg/cattle x 1,500 animals/d x 264 d/a	=	19,000 t/a
7.7 kg/sheep, goat x 1,000 animals/d x 264 d/a	=	2,030 t/a
20 kg/pig x 500 animals/d x 264 d/a	=	2,640 t/a
		23,670 t/a

- for gland winning

0.45 kg/cattle x 1,500 animals/d x 264 d/a	=	178.2 t/a
0.035 kg/sheep, goat x 1,000 animals/d x 264 d/a	=	9.24 t/a
0.15 kg/pig x 500 animals/d x 264 d/a	=	19.8 t/a
		207.2 t/a

- intestine yield

30 m/cattle x 1,500 animals/d x 264 d/a	=	11,880,000 m
20 m/sheep, goat x 1,000 animals/d x 264 d/a	=	5,280,000 m
18 m/pig x 500 animals/d x 264 d/a	=	2,376,000 m
		19,536,000 m

Dimensioning of the by-product processing plant subordinated to the central slaughterhouse should be based on 23,670 t/a of by-products from the slaughterhouse + 11,900 t of by-products from satellite slaughterhouses + 15,000 t/a diminution of the existing bone pile and thereby allow to process at least 50,000 t/a of by-products.

10.03. ADDIS ABABA - Central By-product Processing Plant

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10.03.02. Capacity determination

10.03.03. Technological description

10.03.04. Economic evaluation

10.03.01. General description

As an alternative for short-term setting up of a new slaughterhouse including by-product processing plant with enough capacity to process slaughterhouse offals as well as by-products obtained from satellite slaughterhouses setting up of a Central By-product Processing Plant for Addis Ababa is recommended.

In this connection imperative attention has to be drawn on the fact that the form of waste disposal practised at present has to be changed for resons of epidemics hygiene and national economy.

Setting up of a Central By-product Processing Plant is a task which can be accomplished on medium-term basis and could be carried out until 1992.

Taking the results of the market analysis into account, it is recommended to conceive such a plant in a way that fabricated final products have the largest possible field of application, satisfy urgent needs on the market, and allow to gain foreign currency or to replace previous imports.

For that reason such a plant has to be suited for animal body meal production as well as for the fabrication of organic fertilizers. Another basic condition is that besides residues from slaughterhouse operations only such raw materials are used which can be won from local resources.

10.03.02. Capacity determination

The yield of by-products for industrial processing is calculated as follows:

11,869	t/a	slaughtering by-products from satellite slaughterhouses
6,500	t/a	manure
15,000	t/a	bones resulting from diminution of the bone pile beside the City Slaughterhouse In a study the FAO estimates the quantity of deposited bones at about 170,000 t.
33,369	t/a	

This quantity of organic raw material is the basis for the production of about 20,000 t of organic fertilizers.
For that reason it is recommended to set up a plant for the production of 20,000 t/a of fertilizers (two-shift operation) and to provide extension possibilities to produce technical fat and animal body meal.

10.03.03. Technological description

Importance of organic fertilizers:

Biological

- Produces highest quality crops
- Prolongs soil fertility
- Improves soil structure
- Helps stop erosion
- Stops groundwater pollution
- Reduces pesticide and fungicide applications
- Stops pollution form organic wastes
- Removes health hazards

Economic

- Reduces farming costs
- Uses production factors that are often wasted
- Creates new jobs
- Benefits national economy by reducing imports
- Promotes national self-sufficiency

Average analysis of organic fertilizers:

- Humus 40 - 50 %
- Nitrogen 3 - 5 %
- Phosphorous 2 - 3 %
- Potash 0.5 - 1 %
- Living bacteria, fungi, actinomycetes:
  more than 1,000,000,000
  per gramme
- Trace elements: Copper, Iron Manganese, Zinc, Cobalt
- Stone meal
- Active Agents: Enzymes

Example for mixing:

20 % horn meal, 23 % bone meal, 10 % fish meal, 20 % straw, 20 % dung, 2 % residues from coffee production, 5 % stone meal produce a fertilizer with the following analysis:

- Nitrogen 5 %
- Phosphorous 4 %
- Potash 0.5 %

Process description:

A Compact Plant for the Production of Organic Fertilizer contains two separate working processes.

a) Preparation of raw material:

Potentially all organic residues can be used as raw material for this commercial organic fertilizer. These are the waste products from agriculture, forestry, market and harvest, fisheries, food and natural fiber processing, breweries as well as animal dung, slaughtering offals, or any urban wastes, sewage sludge, etc. The collected organic wastes are ground, if required, and stored on heaps. The different raw materials are subject to a pre-analysis and are blended after adding organic NPK-additives (through a special dosing system) found within the country. Special bacteria are then added and the fermentation process on compost heaps can start.

Now a controlled fermentation process follows that takes several weeks. During the fermentation process, the different compost heaps are turned over serveral times to speed up the fermentation. After the fermentation is completed, the material goes into the second stage of processing.

b) Fertilizer production:

The fermented material is taken from the compost heaps and fed fractioning unit. Here all the nonground long fibered material is expelled.

After the fractioning process the material passes through the dosing process. Here organic NPK-additives like fish, bone and horn meal are blended in automatically.
After this dosing process an automatically steered mixing and granulating procedure takes place. The granules resulting from this procedure will be fed into the pelletizing process.
This special procedure involves a pelletizing of the granules with stone meal.
The results are pellets with a diameter of 2 - 5 mm (machine-spreadable). Pellets which are too big or too small are sorted out through a special screening process and will pass the finishing process once again. The right pellet is dried in a special process and fed into an automatic weighing unit.
This weighing unit steers a filling unit which fills the material automatically into 25 or 50 kg bags. The filled bags are put in storage.

Necessary machines and equipment:

Raw material preparation

1. Feeding system with accessories
2. Dosing system with accessories
3. Grinding system with accessories
4. Conveying system with accessories
5. Scale unit for raw material
6. Integrated processing and conditioning unit for compost starter
7. Processing unit for slaughtering offals (bones, horn etc.)
8. Main switch board

Fertilizer processing

1. Fractionating system with accessories
2. Feeding system with accessories
3. Silos for fermented material and NPK-additives
4. Dosing/Weighing system with accesseries
5. Mixing/Granulating system with accessories
6. Pelletizing system with accessories
7. Stone powder dosing unit

8. Screening system with accessories
9. Drying system
10. Automatic weighing-bagging system
11. Complete conveying system with accessories
12. Main switch board including automatic controlling system
13. Generator set for emergency supply

Peripheral equipment:

Machinery and equipment

1. Electric power receiving and supply system
2. Water receiving, treating and supply system
3. Stone mill (Most countries have stone mills for road construction. The dust, a by-product of stone mills, can be fed into the OFP).
4. Transportation systems for the collecting of waste
5. Waste water collecting basin
6. Field storage and loading/ unloading facilities of raw materials and product
7. Small laboratory and maintenance equipment

Buildings, foundations, structures, paving and other civil works

All the works such as erection, piping, wiring, painting and others required at the plant site have to be done locally.

Consumption of raw material and additives

Required raw and subsidiary materials

An annual production output of 20,000 tons requires an input of 25,000 tons of organic raw materials.
Raw materials:
Waste from forestry, market, harvest, breweries, animal husbandry (example: chicken and cattle manure) food and natural fibre processing.

7,000 tons organic NPK additives:
bone meal
horn meal
fish meal
processed slaughter offals
stone meal

2.5 tons of bacteria for composting

total: ca. 32,000 t

Consumption of utilities:

Electricity

Rated consumption:
apparent power approx. 500 KVA

Process water:

approx. 200 m^2 / day at two shifts

Fuel:

for electrical emergency supply approx. 30 l/hour is required

Demand for workers:

Item	No.
General manager	1
Technical manager (agr. engineer)	1
Skilled worker (2 men/shift)	4
Unskilled worker (15 men/shift)	30
Total	36

Required floor space:

Required area for plant site

Building (Plant building, warehouse, laboratory, maintenance shop, accommodations etc)	2,000 m^2
Land	20,000 m^2

Extension possibilities:

1. Extension of the organic fertilizer plant

The animal waste from slaughterhouses are an essential component for the production of organic fertilizer. If there are enough slaughter offals, the plant should be extended to the following:

Unit for the production of technical fats

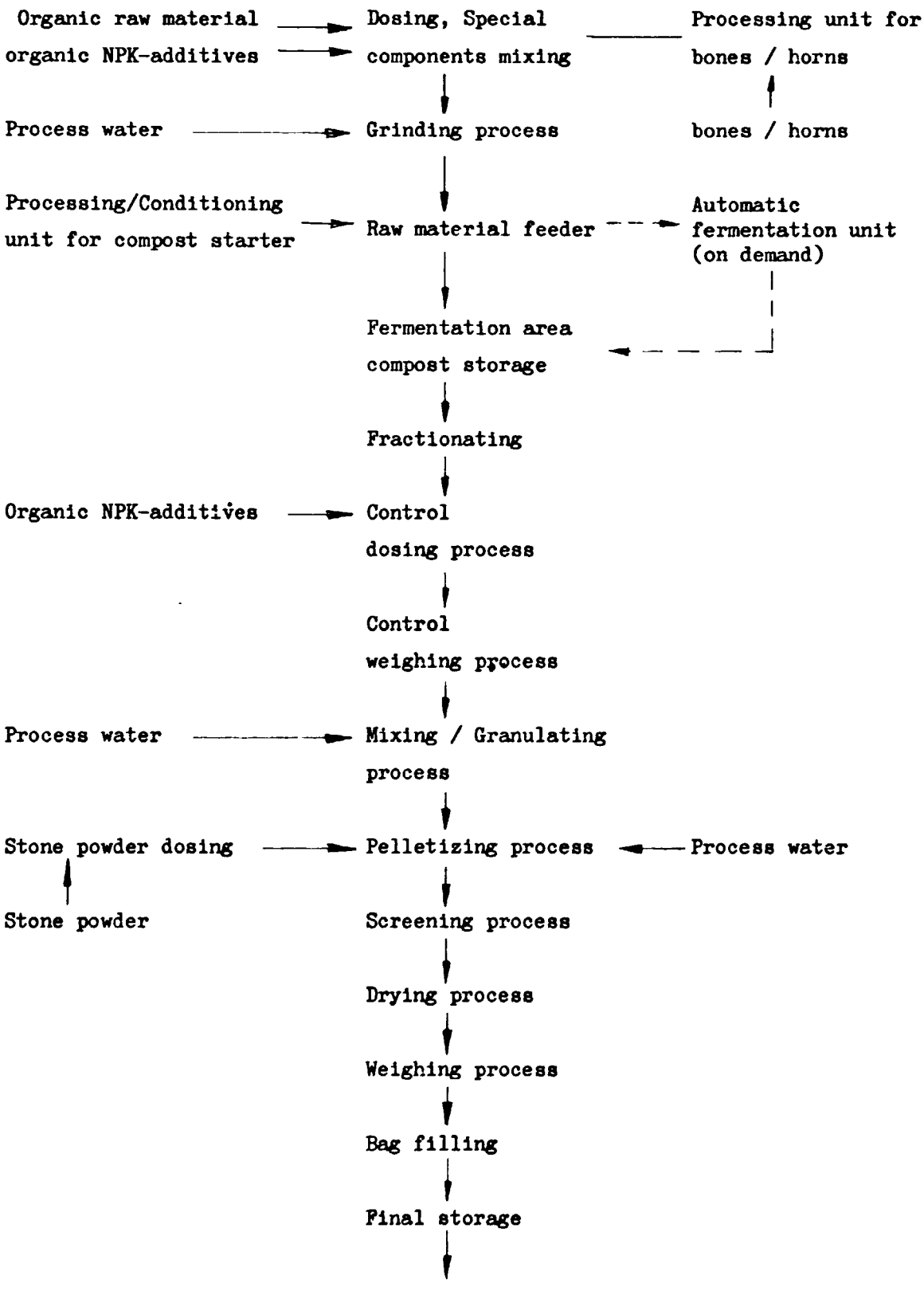
Animal waste from slaughterhouses are defatted. The defatted material is fed into the organic fertilizer plant. The extracted fat can be used as technical fat for chemical factories for the production of soap, cosmetics, plastics, glycerin, fatty acids, etc. This is a profitable proposition.

2. Unit for the production of animal meal

The plant can also be extended into a unit for the production of animal meal. The animal meal thus produced has a high protein content. It is one of the most important basic materials for the animal feed industry.

Technological diagram:

Process flow sheet for organic fertilizer plant (OFP)



10.03.04. Economic evaluation

To set up the suggested plant for the production of organic fertilizers a capital expenditure of about 12 to 15 million birr is necessary (building works and equipment).
The exact extent of investments depends on the degree of complexity of the desired production stage, necessary accessory equipment (power supply, sewage water treatment, etc) as well as development costs concerning the respective site.
If LIMCOR does not plan a plant to produce organic fertilizers (with alternative production facilities for animal body meal), but only a central plant to produce different animal body meals, technology will be simplified, of course, and the extent of investments is reduced by about 20 - 25 %.
Prices obtained for organic fertilizers on the world market at present amount to about US $ 100.- to 110.-, that is, in case of exportation of the total production proceeds up to US $ 2.0 million could be gained from the present point of view.
Domestic prices for organic fertilizers could not be determined in the course of field work.
In any case it is necessary to elaborate a technical and economic feasibility study in the interest of detailed investigation of the factors influencing the choice of an optimum production technology with regard to alternative sites.

10.04. DEBRE ZEYT - By-product Processing Plant

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10.04.02. Capacity determination

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10.04.04. Economic evaluation

10.04.01. General description

At present there is no industrial processing of obtained by-products at Debre Zeyt except hides.
As described under item 5.04. by-products from the slaughterhouse, which are not used for industrial purposes and could be supplied to animal body meal production, total about 3,500 t per year. Also the environs of this site have no processing plant. For that reason setting-up of such a plant nearby the slaughterhouse seems to be worthwhile. This avoids transport distances for raw material and allows technological integration into the course of operations.
The existing production grounds allow such an extension to set up a processing plant. Requirements of technical media can be assured from existing reserves as stated by the partner.
An additional steam generating plant is necessary for the processing plant to operate the respective boilers and autoclaves.
Final products of this processing plant are meat meal, bone meal, blood meal, horn meal, and industrial fat which may be supplied to feedstuff, fertilizer, and soap production.
Appropriate customers could be found in the outskirts of Debre Zeyt (pig fattening station) and in Addis Ababa.

10.04.02. Capacity determination

Altogether 1,925 t of by-products are obtained from cattle and sheep slaughter. In addition the construction of a new cutting-up department within the slaughterhouse is planned. At present this project is in its shell construction stage. This department could supply 1,575 t bones per year.
By-products obtained during service slaughter are returned to customers at present who use them only insufficiently.

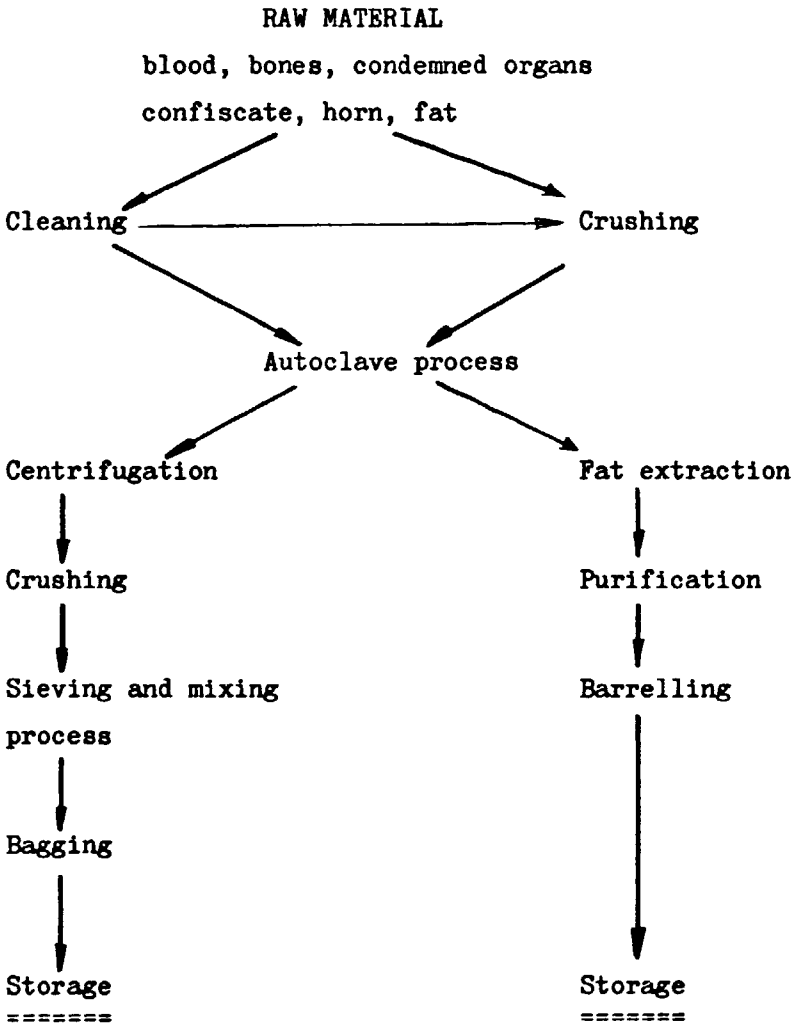
It should be aimed at buying-up the latter and by-products obtained from local slaughter in private households against payment. This quantity could amount to 1,500 t per year. This results in a raw material yield for the new building of:

slaughter	1,925	t
cutting-up	1,575	t
purchasing	1,500	t
total yield	5,000	t

The total yield of final products would amount to about 1,250 t with a gain of 25 % of dry substance as shown by experience gathered in the country.
On the basis of the annual yield 19 t of raw material would have to be processed per working day with 264 working days per year. Three-shift operation is recommended.
This requires an output of 1 t per hour.

10.04.03. Technological description

The course of process is to be taken from the following block diagram:



The plant operates discontinuously and should process 3 t of raw material per boiling process. With the necessary expenditure of 3 hours by-products obtained per day could be processed within 18 hours. The remaining 6 hours have to be used for charging and discharging as prescribed by the course of process.

The demand of workers for the suggested method is:

departmental head	1
foremen	1 per shift
workers	13 per shift
firemen	2 per shift

Required qualifications:

Departmental head	qualification -	short-term course of 8 weeks at home on treatment and processing in processing plants
Foremen	qualification -	short-term course of 6 weeks at home on treatment and processing in processing plants
Workers	qualification -	instruction at existing plant by the staff there before putting into operation
Firemen	qualification -	as prescribed by the partner's laws

10.04.04. Economic evaluation

	local currency (birr)	foreign currency (birr)
a) Buildings and structural works		
1 production building		
350 m²	420,000.-	-
1 office inside the production grounds		
36 m²	14,400.-	-
1 desinfection pool		
4 x 5 m (0.4 m deep)	8,000.-	-
100 m road, 6 m wide	42,000.-	-
1 desinfection station		
for road vehicles	8,000.-	-
other adaptation works	20,000.-	-
	512,400.-	-
b) Technical equipment		
1 bone crusher 2.5 t/h	-	60,000.-
2 autoclaves 1,500 kg 1 autoclave 1,000 kg	-	220,000.-
1 centrifuge 1 t/h	-	25,000.-
1 mincer, dia of perforated disks		
160 - 180 mm	-	80,000.-
1 fat tank 1,000 l	20,000.-	-
2 pumps, nominal width		
60 v = 3 m³/h	-	10,000.-
1 purification basin		
1000 l	10,000.-	-

	local currency (birr)	foreign currency (birr)
1 mill 1 t/h	-	30,000.-
1 riddler 1 t/h	-	40,000.-
3 charging apparatuses with lifting device 0.5 t/h	-	15,000.-
6 worktables 1,800 x 700 mm	10,000.-	-
1 steam generating plant	-	800,000.-
1 electric installation	150,000.-	150,000.-
1 water supply system	150,000.-	-
1 sewage water plant	150,000.-	-
1 bagging scale	-	2,000.-
other equipment	110,000.-	68,000.-
	600,000.-	1,500,000.-
Total	2,100,000.-	

Current costs

	birr/a
material *	171,250.-
wages, salaries	26,570.-
water	-
energy	3,500.-
steam (400,000 l of oil at 0.65 birr each)	260,000.-
maintenance, attendance, repair	252,000.-
depreciation buildings	25,620.-
depreciation technical equipment	210,000.-
extra charge	10,000.-
management / administration	90,000.-
about	1,050,000.-

* buying-up of by-products from domestic slaughtering: 50 birr/t
buying-up of by-products from service slaughtering: 50 birr/t
costs for bones from beboning: -

Receipts

bone and meat meal	1,000 t	300,000.-
blood meal	50 t	22,500.-
industrial fat	200 t	300,000.-
		622,500.-

Cost-benefit-analysis

receipts:		622,500.-
costs:		1,050,000.-
proceeds:	minus	427,500.-

On the basis of the gain price situation for material, costs, and final products the enterprise cannot gain any profit with the suggested plant.

10.05. DIRE DAWA - Meat Factory By-product Processing Plant

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10.05.01. General description

10.05.02. Capacity determination

10.05.03. Technological description

10.05.04. Economic evaluation

10.05.01. General description

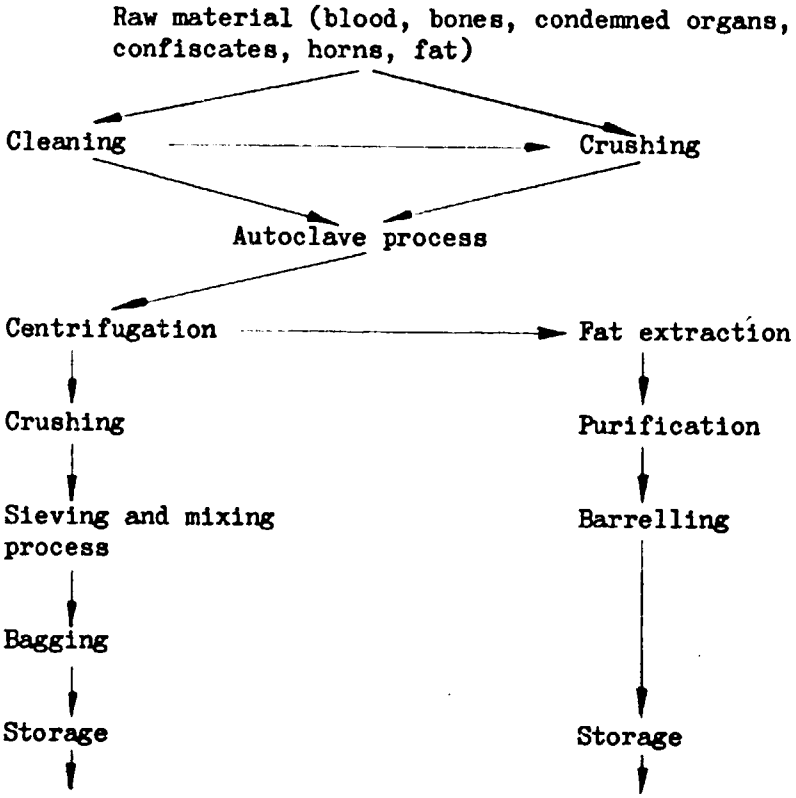
At present there is no industrial processing of obtained slaughtering by-products at Dire Dawa except hides.
As described under item 5.10. by-products which are not used for industrial purposes and could be supplied to animal body meal production total 2,000 t per year.
Taking the slaughtering form in the Meat Factory into account there is a daily raw material yield of 11.0 t.
A processing plant does not yet exist in the environs of Dire Dawa. For that reason setting-up of such a plant on the grounds of the Meat Factory seems to be advantageous, if there are no transport distances and the plant can be integrated into the technological cycle. Existing grounds of the enterprise allow an extension in order to set up a processing plant.
According to the statements of the partner requirements of technical utilities can be covered, steam supply as well. Meat meal, bone meal, and horn meal would be obtained as final products of this plant which could be supplied to feeding stuff, fertilizer, and soap production.
Appropriate customers could be found in the outskirts.

10.05.02. Capacity determination

From cattle slaughter of the Meat Factory 1,400.0 t of by-products are obtained during the slaughtering period. Furthermore also by-products obtained during service slaughter could be processed. These products have to be purchased from the customers against payment. The quantity which is purchased would amount to 600 t per year.
This would result in a raw material yield of 2,000 t for the plant. The total yield of all final products would amount to 500 t with a gain of 25 % as shown by experience gathered in the country.
On the basis of the annual yield 10.5 t of raw material would have to be processed per working day. Three-shift operation is recommended with a hourly output of 0.5 t.

10 .05.03. Technological description

The course of process has to be taken from the following block diagram:



The plant operates discontinuously and should treat 1.5 t of raw material per boiling process. With the necessary expenditure of three hours by-products obtained per day could be processed within 21 hours theoretically.
The remaining three hours have to be used for charging and discharging as prescribed by the course of process.

The demand of workers for the suggested method is:

departmental head	1
foreman	1 per shift
workers	8 per shift

Required qualifications

Departmental head	qualification –	short-term course of 8 weeks at home on treatment and processing in processing plants
Foreman	qualification –	short-term course of 6 weeks at home on treatment and processing in processing plants
Workers	qualification –	instruction at existing plant by the staff there before setting in operation

10.05.04. Economic evaluation

Investments

	local currency (birr)	foreign currency (birr)
a) Buildings and structural works		
1 production building 250 m²	300,000.-	-
1 desinfection pool 4 x 5 m (0.4 m deep)	8,000.-	-
20 m road, 6 m wide	8,400.-	-
1 desinfection pool for road vehicles	8,000.-	-
other adaptation works	10,000.-	-
	334,400.-	-

	local currency (birr)	foreign currency (birr)
b) Technical equipment		
1 bone crusher 2.5 t/h	-	60,000.-
2 autoclaves at 0.75 t each	-	100,000.-
1 blood boiler 0.5 t	2,000.-	-
1 centrifuge 0.5 t/h	-	18,000.-
1 mincer dia of perforated disks 160 - 180 mm	-	80,000.-
1 fat tank 750 l	15,000.-	-
2 pumps nom width V = 3 m^3/h	-	10,000.-
1 purification tank 750 l	8,000.-	-
1 mill 0.5 t/h	-	15,000.-
1 riddler 0.5 t/h	-	20,000.-
1 charging apparatus with lifting device 0.5 t/h	-	5,000.-
3 worktables 1,800 x 700 mm	5,000.-	-
electric installation	100,000.-	100,000.-
1 sewage water plant	120,000.-	-
1 bagging scale	-	2,000.-
other equipment	55,000.-	34,000.-
	305,000.-	444,000.-
total	749,000.-	

	local currency (birr)	foreign currency (birr)
c) Other investment costs		
feasibility study	-	50,000.-
tender	10,000.-	40,000.-
fees, permissions, costs for direction of works	30,000.-	-
qualification	5,000.-	
	45,000.-	90,000.-
total	135,000.-	

Total investment costs

a) buildings and structural works		334,400.- birr
b) technical equipment		749,000.- birr
c) other investment costs		135,000.- birr
	Total	1,218,400.- birr

Labour

1 departmental head		9,600.- birr/a
1 foreman per shift		5,400.- birr/a
8 workers per shift		15,840.- birr/a
	Total	30,840.- birr/a

Current costs

material *[1] (600 t)	30,000.- birr/a
wages, salaries	30,840.- birr/a
water *[2]	-
energy *[2]	-
steam *[2]	-
maintenance, attendance, repair	89,880.- birr/a

depreciation building	16,720.- birr/a
depreciation technical equipment	74,900.- birr/a
additives	2,423.- birr/a
management, administration	24,237.- birr/a
	269,000.- birr/a
	50.- birr/t

*[1] purchasing of by-products from service slaughter

*[2] obtained from slaughtering capacity

Receipts

animal body meal (bones, meat, blood)	500 t	250,000.- birr/a

Cost-benefit-analysis

receipts		250,000.- birr/a
costs		269,000.- birr/a
profits	minus	19,000.- birr/a

On the basis of the given price situation for material, costs, and final products the enterprise cannot gain any profit with the suggested plant.
To make the enterprise profitable an annual support of about 20,000.- birr (loss compensation) and, in addition, payment of the single capital expenditure by the State are necessary.

CHAPTER 11

RECOMMENDATIONS FOR PROJECT FOLLOW UP

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11.01. General remarks

11.02. Time table for project execution

11.03. Organizational preparation for execution of the project suggestions

11.01. General remarks

When formulating suggestions for modifications and new projects, the author of this report has taken into consideration that lasting amelioration of the use of by-products requires a complex of measures and can only be achieved in the course of a longer period.

In many cases economic production results can already be considerably improved by organizational modifications in the production process on the basis of exchange of experience between the different slaughterhouses.

For lower investments up to US $ 100,000.- project-related applications for financing support should be filed the UNIDO or the UNDP.

11.02. Time table for project execution

No	proposal	time table 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96	activities
1	Processing of bone pile in Addis Ababa City Slaughterhouse	.....	Projectpreparation Municipality, UNIDO Consultant Projectexecution Municipality, UNDP
2	Winning of intestines, blood, plasma and glands in all of the slaughter-houses	.....	Projectpreparation LIMCOR, Municipalities UNIDO/UNDP Consultant Projectexecution LIMCOR, Municipalities UNIDO/UNDP
3	Organizational measures for sausage production which concern the range of production in Kaliti and Asmara (Horticulture)	———	Projectpreparation LIMCOR, Ministry of Agriculture Consultant (for recipies) Projectexecution LIMCOR, Ministry of Agriculture Consultant

11.02. Time table for project execution

No	proposal	time table 87 88 89 90 91 92 93 94 95 96	activities
4	Measures for sausage production which require further equipment in Malge Wondo, INCODE Asmara, Dire Dawa, Gondar	.....	Projectpreparation LIMCOR, Consultant UNIDO/UNDP Projectexecution LIMCOR, UNIDO/UNDP Consultant
5	Reduction of coldstorage shrinkage in Gondar Meat Factory	.....	Projectpreparation LIMCOR, UNIDO/UNDP Supplier of cold store equipments Projectexecution LIMCOR, Supplier of cold store equipments
6	Reduction of coldstorage shrinkage in Asmara INCODE Slaughterhouse	.....	like item 5
7	Improvement of skin quality by skinning devices in all slaughter-houses except Dire Dawa	.....	Projectpreparation LIMCOR, UNIDO/UNDP Supplier of equipment Projectexecution LIMCOR, UNIDO/UNDP Supplier of equipment

No	proposal	time table 87 88 89 90 91 92 93 94 95 96	activities
8	Erection of new dump grounds for manure in all slaughterhouses	.....	Projectpreparation and -execution LIMCOR, Municipalities
9	Erection of new by-product processing plants at Debre Zeyt and Dire Dawa		Responsibility LIMCOR
	feasibility study	———	UNIDO/Consultant
	project documents	———	Supplier
	execution	———	LIMCOR, Supplier
	putting into operation	———	LIMCOR, Supplier
10	Central by-product processing plant in Addis Ababa		Responsibility LIMCOR
	feasibility study	———	UNIDO, Consultant
	project documents	———	Supplier
	execution	———	LIMCOR, Supplier
	putting into operation	———	LIMCOR, Supplier

11.02. Time table for project execution

No	proposal	time table 87	88	89	90	91	92	93	94	95	96	activities
11	Alternativly to the Central by-product processing plant erection of a new slaughterhouse with by-product processing plant at Addis Ababa											Responsibility: Municipality of Addis Ababa
	feasibility study	———										UNIDO, Consultant
	project documents			———								Supplier
	execution					———	———	———	———	———		Municipal, Supplier
	putting into operation										———	Municipal, Supplier

11.03. Organizational preparation for execution of the project suggestions

1. Application for shutdown of the City Slaughterhouses in Asmara and Dire Dawa at the responsible government authorities (with contribution of the Central State Planning Commission - ONCCP).

2. Project tasks for modifications formulated in detail in close cooperation between APSS, LIMCOR, slaughterhouse managements with possible contribution of foreign consultants.

3. Application for further support for the project suggestions at the UNIDO (procedure:

   a) LIMCOR at the Ministry of State Farm Development

   b) Ministry by the UNIDO representation at Addis Ababa to UNIDO / Vienna

   c) contribution in formulating UNIDO conditions for invitations for tenders for consultants and suppliers).

4. Demands prepared on a long-term basis concerning delegation of specialists for project preparation, execution, and setting into operation at the UNIDO, partner countries or known partner firms.

5. Elaboration of feasibility studies for new projects (Debre Zeyt, Dire Dawa, Central Plant Addis Ababa) either by the APSS or specialized consulting firms.

   Basis: Application for the projects at the Central Planning Committee for inclusion into the plan documents for the current or the next 3-year plan.

Annex 1

Product range of sausage production - Asmara Meat Processing Factory

(Horticulture)

Kind	Production 1985
mortadella	32.8 t
salami	4.6 t
boiled ham	10.2 t
streaky bacon, smoked	2.3 t
bacon, salted	4.6 t
knackwurst	1.2 t
carré	3.7 t

Annex 2

Suggestion of the range of products for sausage processing plants and recipe specifications

	Processable by-products for 100 kg of raw material (kg)	Natural intestines per 100 kg of raw material (m)
1. Blood sausage	25	50
2. Jellied pig's head	22	30
3. Fine liver sausage	35	140 - 160
4. Liver sausage with onion	48	140 - 160
5. Lung sausage	40	165
6. Frankfurter	3 + 35 l plasm	600
7. Thick frankfurter	6 + 35 l plasm	240
8. Garlic boiling sausage	5 + 35 l plasm	180
9. Grill sausage	4 + 35 l plasm	220
10. Mortadella	13 + 30 l plasm	30
11. Neck meat sausage	20 l plasm	30
12. Boiled salami	3 + 3 l plasm	120
13. Mettwurst - fine (soft pork or beef sausage for spreading)	5	120
14. Knackwurst	5	100 or 220
15. Salami	5	180
16. Saveloy	-	125
17. Carpathian salami	-	130
18. Tongue sausage	40	120
19. Brain sausage	30	130

Annex 3

Prices for slaughterhouse by-products

(Basis for economic evaluation)

By-product	Price (birr)
animal body meal (blood, meat, bones)	500.- / t
blood (human consumption)	300.- / t
blood plasm	350.- / t
blood meal	450.- / t
organic fertilizers (contents of stomach and intestine)	100.- / t
by-products for direct human consumption	2,000.- / t
glands	5,000.- / t
intestines	10.- / 100 m
hair	1.80 / kg
gelatin	3,250.- / t
industrial fat	1,500.- / t
paunch	1,000.- / t
hides	9,000.- / t

Price for purchasing of slaughterhouse by-products

	birr
head and lower legs	0.60.- / animal
raw material	50.- / t
technical fat	4.- / 17 kg
working days per year	264
annual income/worker	660.- birr
annual income/foreman	1,800.- birr
annual income/departmental head	9,600.- birr

Normative service live

- technical equipment	10 years
- buildings and structural plants	20 years

Price for slaughtering cattle	20.25 birr
Price for slaughtering sheep and goats	2.00 birr
Price for slaughtering pigs	5.00 birr

25 % dry substance of blood, bones,
and meat from 100 % raw material

30 % yield of contents of stomachs
and intestines from
100 % raw material

costs for production areas	1,200.- birr / m^2
costs for offices	400.- birr / m^2
costs for streets and roads	70.- birr / m^2

oil for steam generation	0.65 birr / l

World market prices for processed by-products:

bone meal	205.50 US $ per t
meat and blood meal	195.00 US $ per t
intestines	4.00 US $ per 100 m
technical grease	732.00 US $ per t
glands	2.440.00 US $ per t