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HANDICRAFT & SMALL SCALE INDUSTRY PROJECT,

SECOND PHASE

(UNIDO PROJECT DP/ETH/83/012)

PROJECT IDENTIFICATION

CONSULTANCY

TERMINAL REPORT

SUBMITTED TO:

UNITED NATIONS

INDUSTRIAL DEVELOPMENT ORGANIZATION

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AUGUST 1, 1985

ABBREVIATIONS

AETSC	Agricultural Equipment and Technical Services Corporation
AIDB. NK	Agricultural and Industrial Development Bank
AI.CO	Agricultural Inputs Supply Corporation
AMCE	The Automotive Manufacturing Company of Ethiopia
DPSA	Development Projects Study Agency
EC	Ethiopian Calendar
EELPA	Ethiopian Electric Light and Power Authority
EBCA	Ethiopian Building Construction Authority
ETCA	Ethiopian Transport Construction Authority
ETHOF	Ethiopian Household and Office Furniture Corporation
ETIMEX	Ethiopian Import and Export Corporation
IPS	Industrial Projects Service
NCC	National Chemical Corporation
NMWC	National Metal Works Corporation
SPIDE	Spare Parts Importing and Distributing Enterprise
SSI	Small Scale Industry
TS	Telecommunications Service
WUAR	Wood Utilization and Research Center

CONVERSION FACTOR

$ 1 U.S. = 2.07 BIRR.

ABSTRACT

This document was prepared under the consultancy component of the Handicraft and small scale Industry Project.- Second phase DP/ETH/81/012 during the period May 14 - August 4, 1985 in Ethiopia.

The major objectives were to assist the Handicrafts and Small-scale Industries Development Agency (H.SIDA) in identifying a number of new industrial projects for potential investors and to prepare profiles on the more promising ones. Other objectives were to review and make recommendations on H.SIDA's project preparation and evaluation system, to undertake a short training programme for H.SIDA project staff and to consider H.SIDA computer needs.

Besides some 46 projects concurrently being considered by an Ethiopian government owned consulting service for H.SIDA's proposed industrial estate, the team identified 87 project ideas of which 45 were developed into project profiles. It is intended that the project idea pipeline and profiles be updated periodically so that H.SIDA staff can react to current developments and be in a position to provide timely and more detailed advice to potential investors.

A short review of H.SIDA's projects activities system indicated a need for strengthening of the staff's technical ability, possibly through training programmes or industrial exchange programmes, supported by strengthening of H.SIDA's library through the procurement of books on industrial processes. Increased attention to foreign exchange effects as a standard feature of project appraisal appears warranted.

It is suggested that development of a computer system at H.SIDA be planned, starting with a PC-based system which is compatible with desired future expanded capabilities.

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INTRODUCTION

This document is the result of a request by the Handicrafts and Small-Scale Industries Development Agency (HASIDA) to UNIDO for assistance in identification of new industrial projects for potential investors, identified as private entrepreneurs and possible future industrial cooperatives. UNIDO agreed to provide two consultants in project identification, an engineer and economist, under the consultancy component of project DP/83/012 for a period of 2½ months subsequently extended to three months. The consultants arrived in Ethiopia on May 16, 1985 and departed August 4, 1985.

This document is a joint terminal report and also contains as annexes the technical documentation required as well as a review of team activities and findings in the industrial sub-sectors to facilitate future follow-up by HASIDA.

Original objectives of the consultancy were:

To identify at least 100 industrial project ideas
From these prepare project profiles for at least 50 projects
Review HASIDA's project preparation and evaluation systems and make recommendations
Undertake a short traing programme for HASIDA's project study staff.

Upon arrival the Economist was also requested to review and make recommendations on HASIDA computer requirements. / Due largely to a similar concurrent activity being carried on for HASIDA by Industrial Projects Service to develop at least 30 feasibility analyses for projects suitable for a proposed industrial estate and HASIDA's request not to duplicate activities, the number of ideas and profiles fell marginally short of the desired number at 87 and 45 respectively. The details specified to be in the project profiles were generally fulfilled with the exception of brief economic and financial analysis duebasically to lack of current information on raw-material and equipment prices. It

It is also noted that the short time available did not allow the team to travel as much as required to make a proper evaluation of the potential for regional industries.

The other objectives are considered to have been fulfilled although the preparation and evaluation system review cannot be considered as exhaustive due to the effort required on the first two objectives. Training was accomplished by involvement of MASIDA staff in the information gathering process with a review and question/answer session at the completion of the assignment.

The full co-operation of the staff of MASIDA and other organizations contacted is noted with appreciation.

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RECOMMENDATIONS

1. HASIDA Project Preparation and Evaluation Systems

Given a perceived weakness in industrial process expertise and the likelihood that experienced engineers cannot be secured, it is recommended that consideration be given to strengthen the technical background of existing staff through training courses, exchange programmes with industry and provision of technical books focussing on industrial processes for the HASIDA library. Some formalizing of the evaluation of foreign exchange effects as a standard feature of all appransal reports appears warranted.

2. Follow-up on project ideas and profiles

It is recommended that periodic updating of the project ideas pipeline and the individual profiles be done to keep abreast of developments in various industrial subsectors to improve the timeliness and depth of information provided to potential investors. Follow-up is also required in the near term to obtain information promised by various companies during the course of this study but not yet received.

3. Computer requirements

It is suggested that a phased approach be made in building up computer expertise and capacity, starting with a PC-based system which is compatible with desired future expanded capabilities. It is noted that such a computer would significantly ease the updating process under 2. above.

I. PROJECT IDENTIFICATION AND PROFILES

A. Methodology

Although a sector-by-sector analysis process was generally followed, delays in receipt of information and differing potential among sectors meant that a flexible approach was used in identifying project ideas and preparing profiles. Various information sources addressed are listed below and also in the Industrial Sub-Sector Review (Annex I).

1. Industrially related studies by international bodies

All available reports on particular sectors and industries mainly from UNIDO for the last 5 years in Ethiopia were reviewed. Reference was also made to UNIDO's publication " How to Start Manufacturing Industries " and the Indian Government volumes " Project Profiles on Reserved Items". 1979.

2. Public sector bodies involved in industry

To obtain information on general developments and future plans, contact was made with Industrial Projects Service (IPS), Development Projects Study Agency (DPSA), Agricultural and Industrial Development Bank (AIDBANK), Ethiopian Import and Export Corporation (ETIMEX) and Ethiopian Household and office Furniture Corporation (ETHOF). Many others visits were made to particular public industries and are discussed under the particular sub-sector review.

The general approach used was to have a discussion with the organization on its activities followed by a preliminary exploration of anciliary product possibilities. This was followed up, if promising, by visits to obtain detailed information. Use was made of a survey form (Annex IIA) " Ancillary Items with Potential for Supply by SSI's. " Due to shortage of time, it was not possible to make extended trips into the regions. Thus the team was unable to fully explore the potential for regional industries.

3. Consumer products surveys

A form (Annex IIB) was developed to aid in identifying potential consumer products. Due to the largely fragmented consumer market as well as the many import routes, this did not prove successful in the short time available. This is an area justifying a more detailed investigation by HASIDA.

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4. Government publication

Of particular relevance to the studies were:

Annual External Trade Statistics (1976-1982)
Statistical Bulletin - Min. of Industry (May. 1984)
Ethiopia Statistical Abstract - Central Statistical Office (1980 latest)
Master List of Projects and Programmes Under the Ten Year Perspective Plan (1983/84-1992/93) (Nov.1984)

B. Relevant factors

In addition to the wider concerns of market and source limitations, there were certain particular factors which were taken into account in choosing sectors and types of activities on which to concentrate.

1. Public sector activity

While there is little formal indication of the allocation of particular sectors to public or private ownership, some assumptions were made on likely attitude to private initiatives. Thus the following industries were excluded from consideration as being the sole responsibility of the public sector.

- printing and publishing (large scale)
- large scale textiles
- large scale beverages
- pharmaceuticals
- leather tanning
- sawmills (mainly due to shortage of wood)

2. Adequate capacity/known technology already existing

The following sectors were excluded because there is considered to be adequate capacity and/or the technology is already well-known in Ethiopia.

- soap/detergent making
- garment making
- leather products including shoe-making
- concrete building products.

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3. Investment limit

The upper limit for productive investment, i.e machinery and equipment, was set at Birr 500,000 (approximately US 250,000) in line with current RASIDA guidelines.

4. Investment plans of public sector

Public sector plans were examined in respect to the potential market which largely resulted in excluding direct competition except where small-scale manufacture is considered particularly appropriate e.g. bicycle assembly.

5. Market potential

In most cases profiles were prepared for projects where there is at least a reasonable prospect of sufficient market size.

Difficulty was experienced in obtaining a reasonable idea of market size especially for consumer items for the following reasons.

- Official trade statistics are only available currently up to 1982. Due presumably to foreign exchange constraints large fluctuationswere observed in many items in the period examined (1976-1982). In many casealso the statistics do not disaggregate to the extent desired and time did not permit detailed follow-up with the Customs and Excise Tax Administration Department. The team attempted to overcome this short-coming by contacting the particular companies importing although this could only be done when there was only one or few companies involved.
- There is a known large but unquantifiable unofficial import trade which does not appear in official statistics.

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6. Profiles being prepared concurrently for the HASIDA industrial estate.

HASIDA commissioned Industrial Project Service (IPS) in late 1984 to prepare project profiles on some 50 projects together with feasibility analyses on at least 30 of the more promising possibilities. To avoid duplication of effort the team was requested to refrain to the extent possible from preparing profiles on some 64 ideas listed at the time of our arrival, which number was trimmed to 46 by the end of the study.

7.. Economic value to Ethiopia

Relatively little attention was focussed on projects which, although perhaps having market potential, would contribute little to Ethiopia's economic health.

Effort was made to investigate projects having the maximum use of local resources. Unfortunately it was found that except possibly in agriculture, present natural resources are relatively unexploited and little surveyed. Also since the steel-making industry is not fully developed most of the materials could be imported for the metal-working sector, where many of the apportunities were found to be.

As a result of these factors, potential projects were found to fall mainly into the following broad categories.

- ancillary items for industry - import substitution
- consumer items - import substitution

There are also some proposals, including possibility for exports, in sectors utilizing Ethiopian natural resources, especially agriculture.

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C. Project Idea Pipeline (see Annex IV)

The project pipeline lists all known industrial projects of potential interest to the private sector which are not currently being developed in conjunction with particular investors. These include the profiles developed by the UNIDO team (45 projects), other ideas identified by the team for further exploration (42 items), projects being analyzed by IPS (46) plus several others being explored by Aidbank.

It is intended that the list be used to advise potential investors of the current status of various ideas identified as possibly suitable to private industry. In addition it will be useful as a basis for HASIDA to monitor developments in various areas related to small-scale industrial development. This list would be a prime candidate for computerization to ease the difficult job of constantly updating a typed list.

D. Project profiles (see Annex V)

Prime effort was placed on identifying market possibilities and developing the processing parameters to meet the capacity seen as reasonable in view of apparent market size. Given the lack of information on current costs for capital investment items as well as raw materials, it was considered of little use to attempt profitability analysis in the short time available. Instead overall estimates were made for the approximate magnitude of costs for machinery and equipment, buildings and working capital with profitability projections as well as other detailed analysis left to the feasibility study stage.

It will be noted that the depth of analysis varies from profile to profile due to the depth of information which could be obtained or developed in the time available.

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The profiles are organized in the following manner.

Product and uses
Market potential
Capacity
Process description
Raw-materials
Machinery and equipment
Personnel
Land and building area
Capital outlay
Remarks

II. HASIDA PROJECT PREPARATION AND EVALUATION SYSTEM

Given the stress on project identification activities, the UNIDO team could not make a thorough assessment of HASIDA's project preparation activity. However from informal observation and contact with departmental officers, some overall conclusions were drawn.

There are presently eight officers, all Economists under the Head, Project and Planing Dept. The number of projects in the departmental pipeline is summarized as follows.

Year	No. of new projects presented	No. of projects approved	No. of projects rejected not approved	No. of with drawn projects due to promoters	No. of projects on hand at year end
1974 E.C (1981/82)	27	9	6	7	5
1975 E.C (1982/83	52	14	15	-	28
1976 E.C. (1983/84)	66	20	30	20	24

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A review of sample project appraisal reports shows that financial and marketing analysis practices appear acceptable. Economic factors are not usually dealt with in a quantitive way due largely to the size of the projects. The weakest area appears to be in the consideration of technical matters which is understandable given the academic qualifications of the officers and lack of practical industrial experience. This is offset to some extent by consultation with HASIDA workshop engineers but major reliance is usually placed on the entrepreneur, who is often weak in technical matters also. Although technical people are difficult to obtain especially for such activities, it is suggested that alternate methods be explored to give existing officers some technical background. This could be in the form of courses with a technical component or possibly an exchange programme with industry. Strenthening of HASIDA's technical library with practically oriented technology and process technical books in the areas applicable to HASIDA's appraisal activities, is also recommended.

It was noted on the project appraisals reviewed that economic and foreign exchange considerations were considered in a qualitative way. It was explained that quantitative estimates of foreign exchange effects are made on certain projects when considered necessary. In the present climate of foreign exchange shortage, it is suggested that this be formalized for all projects. The need for quantification of economic factors i.e. shadow-pricing etc. is not considered warranted due to the small project size and difficulty in procuring foreign exchange which in itself encourages the entrepreneur to maximize use of local resources including labour.

There does not appear to be any significant improvement possible in the speed of evaluation since much of the delay is in obtaining information. A computer could help somewhat but its likely benefit is probably more in improved quality through the ease in doing sensitivity analyses than in the saving of time. One possibility is in better coordination of activities with AIDBANK who reappraise projects totally when presented with a loan application.

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The Project Preparation Department in general reacts to proposals presented by entrepreneurs. It is felt that HASIDA could be more promotion-minded not only through the preparation of industrial profiles but also in the monitoring of industrial-related activities by other bodies such as Min. of Agriculture, Min. of Forestry, Industrial Corporations. By keeping up-to-date on related developments, HASIDA can better react to changes affecting present project ideas and creating opportunities for new ones.

III. COMPUTER REQUIREMENTS OF HASIDA

A draft proposal (Annex III) was submitted to HASIDA on July 9,1985 concerning possible options in developing a computer system to facilitate certain of HASIDA's activities.

Subsequent discussion revealed another possible use not considered at the time. This would be in the provision of accounting services to various cooperatives, a function which is at present not performed on a formal basis by HASIDA.except in its annual audit of cooperative accounts. Should this become a definite need, then it is apparent that a PC based system as proposed would not be sufficient and instead a larger system would be justified. Given the uncertainty in this area a phased approach starting with a PC system would still seem to be the preferred way, as long as equipment compatibility is assured.

ANNEX I

SUB - SECTOR REVIEW

31: MANUFACTURE OF FOOD, BEVERAGES AND TOBACCO

The analysis of this sector concentrated on using crops which are or are expected to be significant and amenable to industrial processing. Contacts were therefore made with agriculture personnel at the Ministry of Agriculture and particularly with Mr. T.H. Jackson Senior Technical Adviser of GTZ, West Germany who is concerned with development of crop production and processing for the Horticultural Development Department of the Ministry of State Farms.

His General comments were as follows:

- projects involving cans or bottles for finished products are difficult to implement due to the cost of materials and difficulty in procurement.

- projects most desirable are those which maximize the amount of processing at the growing site thus saving on transportation costs and reducing the size of the central facility, which usually involves significant foreign exchange costs.

- crop processes involving natural drying to the extent feasible are most appropriate to Ethiopian conditions both for export and domestic use, although artificial drying is also required to finish certain products for long-term storage mainly for export.

- the same processing equipment should preferably be used for various crops to allow it to be used as much of the year as possible. This is especially true for high capital cost equipment. As an example the Merti Processing Plant is not processing tomatoes for seven months of the year and then switching over the citrus processing.

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- particular projects he felt could be considered for small-scale industrial involvement were raisin production, drying of vegetables - onion and garlic being the simplest, the honey industry, rural open pan boiling of gur unrefined sugar, cassava and pyrethrum.

Contacts were also made with Addis Ababa abattoir, Gu'ele Soap Factory and the Feed Corporation to explore the potential for animal by-product utilization especially tallow and bone meal.

Since the sugar industry is a major one; a visit was made to the Ethiopian Sugar Corporation to discuss potential for sugar by-products and ancillary projects. There are currently three sugar factories supplying pure white sugar essentially for the domestic market. Further expansions and new plants are planned to supply the domestic market also. Investigations are underway to determine the most economic scale of plant as well as the potential for production of Kandhari sugar (95.4% pure). Studies will compare the costs of traditional large plants and smaller ones costing some Birr 8 - 16 million each.

The following studies are being pursued concerning utilization of by-products.

- an ethanol and bakers yeast plant to utilize 71,000 tons of molasses, virtually the total present supply.

- utilization of filter-mud (3% of output) as a fertilizer to replace existing imported fertilizers in up to 20% of the planting areas.

- extraction of cane-wax from filter-mud for use in wax polishes by the Ethiopian Chemical Corporation. (This may not be economic due to the expensive technology involved for what is likely to be a limited market.)

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- utilization of some of the 6000 tons/annum of bagasse ash in glass-making by Addis Glass Factory. (Tests were successful but better methods of carbon removal are required).

The corporation has fairly complete work-shops which can do most machining required as well as casting of bearings in white metal, bronze and aluminium. A desire was however expressed for the ability to procure heavy castings (2 tons and above) from domestic sources.

Opportunities were not pursued in traditional industries such as milling of oil or flour and beverage production as they are generally done by public industries and the technology is well known. There is small scale production of such items as wet, honey and peanut butter. Limitations of these products seems not so much with technology, although this may be a factor, but instead is in the marketing area where poor packaging standards imply a second-class product.

In general projects in this sector must be considered as having long gestation periods due to the need to carefully evaluate and develop the resource.

32: TEXTILE, WEARING APPAREL AND LEATHER INDUSTRIES

The mechanized textile industry is basically a large-scale government-owned one and with the possible exception of terry fabric there does not appear to be prospects for small-scale textile manufacture.

The garment industry is well developed with many private and some public enterprises competing. Although there are large volumes of smuggled textiles consumed in the country this appears to be more due to a shortage of desired types of cloth and the prestige of import labels than in any shortage of clothing manufacturers. It was therefore concluded that the potential for diversification of garment manufacture is quite slim and in any case profiles are not necessary for products already made in the country.

Primary effort was given instead to the identification of products used in volume in the textile manufacturing process, particularly the mechanized sector since the hand loom sector is still at a relatively early stage of sophistication. Contact was therefore made with the National Textiles Corporation which oversees nineteen textile factories and also directly with two of these factories, Akaki Textile Factory and Ethiopian Fibre Factory, to develop a list of potential items for manufacture by small scale enterprises. This list was then circulated to the more distant factories to obtain their requirements of the same or similar products. Although not all factories replied there were sufficient response to allow certain conclusions on potential supply to be made as summarized in the following list.

Potential Ancillary Items for Textile Industry

(* indicates a profile has been prepared)

A. Good prospect for domestic supply

Wooden shuttles*

Wooden bobbins and cones*

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Spindle tape*
Heald plates*

B. Possible supply

Plastic picker - by existing plastics co.
(Leather pickers are obsolete)
Plastic cones/bobbins - by existing plastics co.
Castings by foundry*
Weft fork - by die casting*
Starch*

C. Unlikely supply (for reasons shown)

Sliver cans - low volume/lack of appropriate material
Paper cones & tubes - low volume
Wire healds - specialized eqpt/low price
Heald frame - low volume
Bottom apron - under development
Wood picking stick/side lever - low price for volume and high quality required
Weft grate - low price/low volume

Although the leather industry is a significant one, the existing public tanneries and public and private leather goods manufactures - mostly in shoemaking-appear to adequately cover the market. The development needed here appears to be more one of upgrading existing industry than in encouraging new ones. The recent start-up of Universal Leather Articles to manufacture many different items for export and domestic sales such as footballs, wallets, hand-bags gloves and attache cases reduces potential for new industry in this area at least for the next few years.

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33: WOOD AND WOOD PRODUCTS INCLUDING FURNITURE

The rapid dimishment in Ethiopia's dense forest reserves to some 3.7% of the land area limits industrial potential at the present time. While efforts are being made to reverse this trend, thus will take some time.

Since the sawmills and other large scale industry such as hard and soft board and plywood are virtually all government owned, the potential for small-scale entrepreneurs is mainly in the wood-products manufacturing sector-basically furniture but also other items such as ladders, window frames and doors. The main thrust in this area is by the Wood Utilization and Research Centre (WU.R) which is engaged in various efforts including defining characteristics of various woods (completed for 9 species to date), researching and marketing of veneers of common and uncommon woods, developing simple furniture designs for wide use and studying preservation methods. WU.R is also well placed to assist in the study of possibilities for import substitution of e.g. textile shuttles and bobbins.

The one species which seems quite unexploited and also unstudied is bamboo, particularly the solid core variety Oxythananta abyssinica which is reported to cover some 450,000 hectares in Welega Region as well as a smaller area in Sidamo region (equivalent to more than 10% of Ethiopia's dense forest cover). A draft proposal for a development project as well as project profile have therefore been drawn up covering the utilization of bamboo.

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34: MANUFACTURE OF PAPER AND PAPER BOARD, PRINTING & PUBLISHING

The potential for small-scale industry is limited due to the shortage of forest resources with the result that all pulp and paper is currently imported, the government monopoly on printing and publishing and the extremely low consumption of paper in Ethiopia (0.3-0.4 Kg./person/yr.) which reduces potential for even waste-paper based projects.

Although efforts are being made to utilize other resources such as bagasse and (in the long term) to harvest forest plantations, this will be intended for a proposed national paper-making company.

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35: MANUFACTURE OF CHEMICALS AND OF CHEMICAL, PETROLEUM, COAL, RUBBER AND PLASTIC PRODUCTS

Factors limiting potential for small scale entrepreneurs in this sector are the high capital cost of minimum-scale projects especially in the basic chemical field and the present limited known or exploited resources base thus causing most production inputs to be imported.

A visit was made to the National Chemical Corporation (NCC), the major company in the sector, to discuss products presently being manufactured as well as future plans, to determine the potential for ancillary and complementary industries in this sector. NCC oversees 15 factories broken down as follows:

Soap	5
Salt	2
Plastics	2
Paints	1
Gases	1
Batteries	1
Cartons	1
Other chemicals	2

Products made presently and planned are as follows:

1. Laundry, toilet soap and detergents
2. Salst
3. Plastic utensils
4. Paints (all types)
5. Sodium Silicate
6. Cartons
7. Batteries for cars
8. Industrial gases (Oxygen, Nitrogen)
9. Sodium Hypochloride
10. Floor polish

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11. Shoe polish
12. Shampoo (awaiting certain equipment)
13. Printing Ink
14. Iodized Salt
15. Lead Oxide
16. Glycerin

Plans for Future Production

1. Fertilizers
2. Caustic Soda
3. Sulphuric Acid
4. Aluminium Sulphate
5. Sodium Sulphate
6. Pulp
7. Pesticides
8. Glues
9. Essential oils
10. Inedible vegetable oil for tallow substitution
11. Tannin
12. Regeneration of motor oils
13. Bromine (extracted from salt)
14. Gelatine
15. Dynamites
16. Creams
17. Tooth paste
18. Hair oil
19. Abrassive household cleaner (plant currently closed)

While future plans include items which at present would only be justified in a small scale plant (such as items 16-18), it was explained that these were included based on the felt needs of the country and that NCC would not be averse to having such items made in the small-scale sector. NCC considers itself more suited to undertake larger scale industries. In discussing possibilities

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for small-scale industries in other areas, especially plastics, the limitation is not considered to be the lack of ideas for products which can be manufactured but instead is the inability of small-scale producers to obtain adequate stocks of imported raw materials and to a certain extent the technology expertise. Thus two plastic products producers in Asmara are virtually closed for all items except polyethylene sheeting because of raw material shortages. A plastics sector study has however recently been undertaken by the Industrial Projects Service in part to examine prospects for the rationalization of production by NCC plant and the manufacture in the small-scale sector for certain items of marginal interest to NCC.

The large import of soap in recent years was discussed. This situation was not caused by lack of soap-making facilities since, for example, United Oil Mills and Soap Factory has a soap-making plant which is only operating at $\frac{1}{3}$ of its 15,000 ton capacity. This compares to import of 15,169 tonnes of soap in 1982. One limiting factor mentioned is the shortage and poor quality of domestic animal tallow. NCC are attempting to meet this shortage by exploring the potential for substitution with inedible vegetable oils but also see a good potential for small scale regional operators to set up tallow collection and rendering operations.

Other areas of possible interest for small-scale entrepreneurs mentioned was in the processing of currently underutilized naturally occurring species of vegetation such as the wild rubber tree and palms which can be used for fibre, wood, essential oils and button manufacture. This may have potential but the lack of any resource information and the often remote and dispersed character of indigenous vegetation limits current potential for development.

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A visit was also made to the Ethioplastic Factory, a public sector plastics company with responsibility for the manufacture of plastic goods mainly for use in construction. At present articles are largely made from polyethylene chloride (PVC) in the following major categories:

Low density polyethylene film,
Blow moulded items (polyethylene)
Water pipes (40 - 160mm) - PVC
Electrical wiring - PVC coated (including drawing and stranding of copper wire)
Injection moulded items
Floor tiles - PVC
Ball-point pens
Window shutters - PVC

Ethioplastic has many plans for new products including zippers, shrink films, melamine kitchen ware, disposable syringes, infusion bags, plastic sandals, and corrugated roofing, but budget restrictions on related factory building requirements have forced deferral of these plans for 1-2 years. Other public companies make beverage cases (Ethio Gas and Plastic Crates) and household plastic items (EthioFoam and Thermoplastic).

Although plastic manufacturing equipment is generally of a size amenable to small-scale production, production of additional plastic items in new facilities does not appear overly promising for the following reasons. The primary problem is the shortage of imported raw material which affects small private companies more than the public corporations due to difficulty in obtaining foreign exchange permission. Furthermore Ethioplastic's size can justify maintaining a chemist and engineering department while smaller companies do not have the sales level to support such important activities thus resulting in lower efficiencies and poorer quality. The nature of plastic processing machinery is also such that additional product can usually be made with relatively small investment in moulds assuming the plant is not working at capacity. Thus new production can be justified more easily by existing plants.

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36. MANUFACTURE OF NON-METALLIC MINERAL PRODUCTS (EXCEPT PETROLEUM AND COAL)

Products in this sector are mainly cement, cement products, clay bricks, lime, asbestos products and glass bottles and tumblers. Although a thorough survey could not be undertaken, it would appear that small scale enterprises are active in these areas and more can be easily set up as required to make increased volumes of finished products as the market demend and raw material availability (mainly cement) allow. One area with potential is considered to be in small-scale glass blowing/moulding for which a profile has been prepared.

As for chemical production, the lack of detailed information on mineral resources restricts the search for potential projects. Periodic follow up with the Ministry of Mines is recommended to monitor developments.

37: BASIC METAL INDUSTRIES

Due to generally high capital cost and market limitations, small scale opportunities are restricted to foundries and possibly non-ferrous sheet rolling.

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38. MANUFACTURE OF FABRICATED METAL PRODUCTS, MACHINERY & EQUIPMENT

The fabrication of metal products is the sector offering the most prospects for small-scale manufacture. Unfortunately due to the lack of many basic metal industries, most material input will be imported but it is also one which, given necessary equipment and material imports can start up relatively quickly using expertise which is available in the country.

Contact was made with the National Metal Works Corp.(NMWC) to discuss their present and planned production to recognize potential overlaps and also to investigate the potential for provision of ancillary products.

This public corporation manages twenty companies in metal working and engineering industries with the following breakdown: household utensils (4 plants), basic steel products (4 plants), small farm implements, bus assembly, tractor assembly, dry cell batteries, umbrellas and metal and wood furniture manufacture (7 plants). While there are many projects in the pipeline (list attached) which could eventually offer opportunity for ancillary item, the major effort was dedicated at this time to investigation of ancillary items for existing industries where needs are more concrete. The list of ancillary items possibly amenable to small scale production attached was developed in conjunction with the centralized purchasing department of NMWC except for the tractor assembly plant at Nazreth which was visited separately.

The tractor plant started operations in August 1984 and until now has been importing and assembling complete knock down kits of two models of tractor. Current production is at the rate of 500 per annum although with plans to increase to 3000 tractores per annum over the next several years. There has also been a study for a capital investment of some Birr 1.5 billion which would allow domestic production of up to 85% of the tractor parts as well as

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annual production of 400 combine harvesters, 3700 tractor drawn implements and 3500 tons of spare parts. Although this study continues to be under review due to its high cost, the intention was expressed to encourage other domestic companies to produce equipment parts where possible. Specifications and prices for all component parts essential to any proper substitutability study, have been requested from the foreign supplier by tractor plant.

Discussions were also held with A.M.C.E., a company jointly owned by National Metal Works, Fiat and Iveco, the latter two being vehicle manufacturers in Italy. This company manufactures several models of trucks and intercity buses and has a current capacity of about three vehicles per day on one shift or about 800 per year although current output is less than this due to shipping delays. A ten year plan proposes to build this capacity to 3000 vehicles per year through facility expansion. Efforts are continuing to increase Ethiopian content by increasing the work done by AMCE itself and by purchasing more processed goods from other Ethiopian companies. Local content is approximately 20% and it is hoped that this can be increased to at least 70%. AMCE's own operations are being broadend mainly through the purchase of a 215 ton press which will allow most sheet metal to be formed locally.

Items currently purchased from other Ethiopian companies are:

- Wooden truck bodies
- Springs from Ethiospring
- Tires from Addis Tire
- Foam for seats from Ethiofoam
- Electrical wire from Ethioplastic

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Plans are underway to source the following items locally:

- Batteries
- Rubber and plastic products from Ethioplastic
- Paint
- Fuel tanks
- Exhaust pipes and silencers (possibly)

Further items which appear as possible candidates for local sourcing are radiators, seat-covering material, floor covering material, coated sheet metal for bus interiors, small formed/welded metal parts, small forgings and die cast items such as door handles. Detailed information was still awaited at the time of completion of this study.

Several visits were made to the Agricultural Equipment and Technical Services Corporation (AETSC) which reports to the Ministry of State Farms and is responsible in part for import and distribution of tractors, combines, tractor drawn implements and related spare parts as well as overhaul of engines. This corporation also rents out major construction equipment as well as providing technical service to state farms. At present the tractors and combines are imported in finished condition from Yugoslavia and the GDR and all spares are imported also from these and other countries. There has been a proposal to manufacture certain sheet metal assemblies in AETSC especially for combines but budget constraints have forced a deferment of such activities. While there is little potential for producing certain items for new tractors and combines at present, there does seem to be better potential for production of spare parts since AETSC is free to purchase wherever it wishes. While a serious study would have to be made before production commitment, there do appear to be prospects for items such as radiators, sheet metal assemblies, hydraulic piping, certain small forgings, and possibly die castings and weldments. Volume of usage does not permit consideration for manufacture of such engine items as bushings and bearings.

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Contacts were also made with the Ethiopian Transport Construction Authority (ETC.) and the Ethiopian Building Construction Authority (EBC) since they use significant numbers of vehicles. General conclusions supported the provision of items such as EETSC and EMCE use but detailed information was not received by the time of study completion.

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NATIONAL METAL WORKS CORPORATION

List of planned projects

(May 1985)

	Project	Status
1.	Industrial spare parts plant	Being implemented
2.	Electronics goods plant	Survey completed
3.	Welding electrode plant	Study completed-project shelved
4.	Electric lamp manufacturing plant	Feasibility study completed
5.	Tractor and agricultural equipment manufacturing plant	Partly implemented
6.	Improved simple farm implements plant	Protocol signed with Bulgarians to conduct study
7.	Rolling mill integrated with direct reduction plant	Identified
8.	Water pump plant	Being implemented
9.	Motors, transformers & generators plant	Under study
10.	Fasteners plant	Transformed to HASIDA for industrial estate
11.	Pipe fittings plant	Under study
12.	Hand tools plant	Implemented
13.	Electrical fittings plant	Under study
14.	Bicycle and low cost vehicles plant	Under study (with IFS involvement)
15.	Locks and padlocks plant	Identified
16.	Sewing machine plant	Identified
17.	Office and household equipment plant (refrigerators, water heaters washing machines, filing cabinets, etc.)	Under study
18.	Dry cell batteries plant	Under study
19.	Pilot foundry	Under study (UNDP project for training)
20.	Pilot tool room	Under study (UNDP project for training)
21	Engineering design and development centre	Under study
22.	Pilot plant for simple farm implements	Under study (Min. of Agri. to take over)
23.	Lead pencils plant	Study completed

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NATIONAL METAL WORKS CORP.

ANCILLARY ITEMS PRELIMINARY IDENTIFICATIONS

(Tractor assembly plant not included)

I. HOUSEHOLD UTENSILS (4 PLANTS)

Aluminium discs
Aluminium handles
Bakelite handles
Rivets

II. DRY CELL BATTERIES (UNITED ABILITIES CORP.)

Carbon rod
(Size R20 8 mm. diam. x 57 mm., oil impregnated or wax immersed)

III. UMBRELLAS (UNITED ABILITIES CORP.)

Steel wire uncoated 1.95 mm.
" " " 2.00 mm.
Waterproof nylon taffeta cloth
Waterproof cloth religious motif
Springs
Automatic folding frames
Non-automatic folding frames.

IV. ETHIOPIAN IRON & STEEL FOUNDRY

Galvanized steel wire 2.2mm.
(to be drawn to 0.75 mm.)
Dolomite powder

V. ETHIOPIAN METAL TOOLS FACTORY

Plastic handles for machets (new product)

VI. METAL AND WOOD FURNITURE (7 plants)

PVC leather
Upholstery material
Hardening powder (Kaurit)
Plastic sockets
Plastic rails
Glues
Rubber cords

ANNEX IV

PROJECT IDEAS

PIPELINE

OD, BEVERAGES & TOBACCO MFG.

Project	Product/Uses	Remarks
Milk products incl. cheese		AidBank is considering
Raisin production	Raisin for domestic and export markets.	See profile
Citrus juice and oil	Juice for local sale and oil for export	See profile
Dehydration of agricultural products	Fruits, vegetables, herbs and spices	See profile AidBank analyzing also July/85
Rendered tallow	For soap factories	See profile
Rolled grain breakfast cereal	Replacement for imported cooking oats	Oats and other cereals available but market size is questionable.
Syrups	Syrup from sugar-canefor household and industrial use.	Market may be too small to support minimum scale plant. Follow-up required.
Honey & byproducts processing	High quality honey, wax, royal jelly, propolis, pollen, bee venom	AidBank is analyzing. Needs increased number of modern hives to supply quality required. (Tej does not need high quality honey).
Chewing gum	Usually made from chicle	Under analysis by IPS but dropped. DESirably would use local resource if available Market study required.
Tell/Tej brewing	Fermented traditional beverages	Economically questionable since could displace large no. of small brewers without other income sources.
Starch processing	From cassava, potatoes	See profile

32. TEXTILE, WEARING APPAREL AND LEATHER INDUSTRIES

Number	Project	Products/Uses	Remarks
3211	Nylon taffeta cloth	For umbrellas	United Abilities Corp. imported 693,000m. for Birr 1.5 million in 1982/83, 83/84 Process requires investigation.
3211	Canvas coating		IPS analyzing July/85 1.33 million m^2
3211	Spindle tape	Woven tape used in textile machinery	See Profile
3212	Measuring tape	Household & industrial use	Market evaluation required Process is simple.
3212	Terry fabric and towels	For towels, garments	See Profile
3212	Cotton gloves-some rubber dipped	Mainly industrial use	Market size uncertain
3233	Leather board	Made from waste leather mainly for shoe lining	Analysis being finalized by National Leather & Shoe Corp. Initial capacity expected to be sufficient for public and private requirments for some years to come.
3233	Carrying bags	Suitcases, trunks, travelling bags	IPS analyzing July/85 106,000 pcs.
3240	Microcellur sheets	Shoe insoles	Classed with 3560 as plastic

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33. WOOD & WOOD PRODUCTS INCLUDING FURNITURE

Number	Project	Products/Uses	Remarks
3319	Improved Bee-Keeping equipment	Modern Hives of high quality to support processing plant	Already being manufactured by Wanzw Factory (A.A.), ARDU (Bako) and private workshops at Jimma, Sodo, etc., 3000-4000 in use Dec/84
3319	Bobbins and cones	Textile industry	See Profile IPS analyzing July/85 900,000 pcs.
3319	Shuttles	Textile industry	See Profile IPS analyzing July/85 55,000 pcs.
3319	Picking stick	Textile industry	Low price does not justify development effort for volumes needed (e.g. Birr 450 for 3000 picking sticks/yr. at Akaki)
3320	Bamboo furniture and woven panelling	Furniture and housewares	See Profile.

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34. MANUFACTURE OF PAPER AND PAPER PRODUCTS

Number	Project	Products/Uses	Remarks
3419	Book matches	Paper matches for smokers	See Profile
3419	Paper cones/tubes	Textile industry	Little demand seen in responses from textile industry. IPS analyzing July/85 1.3 million pc
3419	Sliver cans of fibreboard	Textile industry	Small volume
3419	Pulp moulding plant	Egg trays etc.,	See profile (not considered promising due to lack of market) IPS analyzing July/85 4 million pcs.
3419	Duplex board lamination		IPS analyzing July/85 1500 tons
3419	Paper coating		IPS analyzing July/85 1,100 tons
3419	Decorative wrapping paper and wall-paper	Household use	Market analysis required.

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35. MANUFACTURE OF CHEMICALS AND OF CHEMICALS, PETROLEUM, COAL, RUBBER AND PLASTIC PRODUCTS

Number	Project	Products/Uses	Remarks
3500	Chemical products from indigenous trees and shrubs	Wild rubber, palms, etc., for fibre, essential oils, gums, etc.	Resource studies and coordination with Min. of Agriculture required. Industrial utilization usually requires imported species in plantation setting.
3511	Calcium corbide	Acetylene production	IPS analyzing July/85 750 tons
3511	Calcium carbonate		IPS analyzing July/85 1,500 tons
3523	Shampoo, topical creams	Personal use	Market size probably requires consideration with profile 3523: Toothpaste.
3523	Toothpaste	Personal use	See Profile
3529	Pencil lead mfg. & carbonrod	To support proposed pencil factory and dry cell battery manufacture	Obtain processing information to determine minimum plant size. One plant proposed but may be separate.
3529	Vegetable tanning extract	For leather tanning	Development requires establishment of plantations.
3529	Printing ink	Printing	IPS Analyzing July/85 300 tons) (NEC Presently producing also)
3529	Essential oil from eucalyptus		IPS Analyzing July/85 8 tons

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3529	Animal by- product utilization particularly bone-meal	Bone-meal mainly for fertilizer	See Profile IPS analyzing July/85 300 tons of glue and gelatin
3551	Bicycle tyres & tubes	Bicycles	See profile
3559	Rubber eraser	Erasing pencil/ink	See Profile
3560	Plastic raincoats and other thermowelded products	Various consumer uses	See Profile
3560	Microcellular sheets	Shoe insoles	IPS analyzing July/85 75,000 sheets
3560	Tooth brush making	Cleaning teeth	See Profile
3560	Plastic bobbins/cones pickers	Textile industry	Insuffieient volume for new industry May interest existing plastics Company.
3560	Disposable plastic syringes	Medical use	Market analysis required.
3560	Plastic eyeglass frames	Personal use	See Profile
3560	Miscellaneous plastic items	Various industrial & household uses	Mainly suited to present plastic industries due to technology limitations and relatively small demand for each item. However, IPS is undertaking plastics sector study for NCC in part to evaluate rationalization and mfr. in small-scale sector.

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3560	Bakelite handles	Cooking utensils	Could be combined with proposed bakelite electrical products operation.
3560	Plastic collapsible tubes	Tooth paste, creams	See profile
3560	Nylon zip fasteners	Clothing	IFS analyzing July/85 600,000 meters.
3560	Fiberglass reinforced plastic products	Tanks, covers, boats, etc.,	Research required to identify products and demand. Capital investment is modest.

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36 MANUFACTURE OF NON-METALLIC MINERAL PRODUCTS (EXCEPT PETROLEUM AND COAL)

Number	Project	Product/Uses	Remarks
3610	Porcelain products	Low tension insulators and ceramic table ware	See Profile
3620	Glassware	Pressed and mouth-blown	See Profile
3699	Abrasive paper & cloth	Sanding	IPS Analyzing July/85 100 tons
3699	Grinding wheels	Industrial use	IPS Analyzing July/85 190 tons
3694	Mill stones	Grinding grain	IPS Analyzing July/85 15,000 pairs
3699	Wood-wool cement board	Building construction	Availability of wood waste is uncertain. Tests required.

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37. BASIC METAL INDUSTRIES

Number	Project	Product/Uses	Remarks
3710	Foundry - cupola furnace	Gray iron castings	See Profile
3710	Foundry - induction furnace	Ferrous & non-ferrous castings	See Profile
3720	Non-ferrous sheet rolling	Aluminium, copper, brass for cooking utensils, foil, handcrafts	Market survey required Current imports seem small but need confirmation.

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38. MANUFACTURE OF FABRICATED METAL PRODUCTS, MACHINERY & EQUIPMENT

Number	Project	Product/Uses	Remarks
3811	Die cast products	Various parts for building, automotive, etc.,	See Profile IPS analyzing metallic door/ window handles July/85 20 tons
3811	Locks and keys	Door locks	IPS analyzing July/85 50 tons
3811	Padlocks	For containers, buildings	IPS analyzing July/85 100 tons
3811	Saw blades	Hacksaw, circular saw, band-saw	IPS analyzing July/85 30 tons
3811	Table cutlery & kitchen knives	Household institutions	See Profile
3819	Sheet metal workshop	AETSC combine harvester parts, etc,	See Profile
3819	Cable making	Steel and non-ferrous cable	Demend low re economic plant size. See Profile 3819: Fine wire
3819	Fine wire drawing	Steel and non-ferrous wire	See profile
3819	Hand pumps	Tyre filling, insectidide spraying	See Profile
3819	Heald plates	Weaving equipment in 3 fibre factories	See Profile
3819	Solar water heaters	Household and institutional hot water	See Profile
3819	Television antenna	T.V. signal reception in distant areas	See profile

3819	Small spring making	Various incl. umbrellas	Few large volume users at present. Could be ancillery line for wire-drawing plant.
3819	Small forgings and weldments	Various	See Profile
3819	Scaffolding & forming pans	Office building construction	EBC. suggested Size of ongoing market potential requires analysis
3819	Back-pack liquid sprayer	Agriculture	See Profile
3819	Pressure cooker	Household use	See Profile
3819	Bolts and nuts (cold formed)	Various	IPS analyzing July/85 150 tons
3819	WOod screws	Various	IPS analyzing July/85 75,000 gross
3819	Stationery fasteners	For box and flat files	IPS analyzing July/85 25,000 gross
3819	Gas cylinders	Household, restaurant use	Demand variable and small for high quality product required. Could be part of existing welding shop
3819	Lanterns	Household use	IPS analyzing July/85 30,000 pcs.
3819	Wickstoves	Household use	IPS analyzing July/85 30,000 pcs.
3819	Water meters	Water distribution	IPS analyzing July/85 60 00 pcs.
3819	Small stamped metal products	Staplers, punches, date pads pencil sharpeners, etc	Market appears too small but requires analysis.
3819	Pins & needles	Safety pins, hair pins, needles.	IPS Analysing July/85 30 tons

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3819	Metal fittings for garments and leather goods	Buckles, straps, rings, etc.	Market analysis required. Demand appears low at present.
3819	Gas cooking ranges	Simple type for household use	Market analysis required.
3822	Small farm implements	Small-scale agriculture	NMWC currently manufacturing various items but quality appears questionable. Would appear best to upgrade NMWC activity desirably with rationalization allowing small-scale participation in certain sectors.
3822	Fabricated parts for carts	To be supplied to small builders such parts as wheeel hubs, axles bearings	Use of carts seems relatively low at present.
3822	Simple metal-working equipment mfg.	Bender, shear, rolling m/c drill, lathe, etc. for rural work shops.	Possibly based on Int. Technology U.K. simple designs.
3829	Concrete mixers	Building	IPS Analyzing July/85 60 pcs.
3829	Wheel barrows	Constructibn, agriculture	IPS analyzing July/85 9300 pcs.
3833	Electric coffee maker	Restauarant use	See Profile
3833	Electric stoves	Including hot plates	IPS Analyzing July/85 5000 pcs.
3833	Sewing machines	Home and industrial use	NMWC has identified as a potential project. Scale required is probably outside H.SIDA scope except for simple assembly operation.
3833	Water boilers and immersion heaters	Household restaurant use	IPS analysing July/85 40000 pcs.
3833	Electric kettles	Household use	Market analysis required. Could be combined with 3833: Water Boilers and Immersion heaters.

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3839	Light fittings	Buildings	IPS analyzing July/85 50,000 pcs.
3839	Flash light (metal)	Dry cell torch for household use	See Profile
3839	Bakelite electrical fittings	Buildings	IPS analyzing July/85 27,000 dozen
3839	Flashlight (plastic)	Drycell torch for household use	IPS analyzing July/85 500,000 pcs. See also profile 3839 Flashlight (metal)
3839	Electric lightbulbs		NMWC has completed project feasibility study. Small-scale assembly operation could be considered using some locally made components if NMWC do not proceed.
3843	Filter elements	Vehicles	IPS analyzing July/85 60,000 pcs.
3843	Automotive radiator and oil cooler		See Profile
3843	Automotive hydraulic tubing and hoses	Hydraulic, air systems in vehicles, agricultural eqpt. construction eqpt.	IPS analyzing also July/85 3,000 pcs.
3843	Brake lining material	Automotive brakes	See Profile
843	Radiator caps	Also fuel, oil caps for engines	Minimum size plant too large but requires confirmation
			Part of 3843: Automotive radiator and oil cooler

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3844	Bicycle manufacturing	Personal	See Profile
3844	Bicycle accessories	Bicycle carriers, kickstand and fenders, chainguards	See Profile
3844	Invalid carriages		Market size of those able to pay must be considered. Might be combined with 3844: Bicycle manufacturing.

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39: Other Manufacturing Industries

Number	Project	Product/Uses	Remarks
3909	Cellophane tape and paper tape	Stationery and packaging use	See Profile
3909	Clock assembly	Household use	Simple project probably using imported battery-powered movements in locally made cases of wood, basket-work etc.
3909	Insulating tape	Electrical insulation	See profile IPS also Analyzing July/85 400,000 rolls
3909	Umbrellas	Personal use	IPS Analyzing July/85 50,000pcs.
3909	Duplicating stencil paper	Office	See profile IPS also analyzing July/85 9.72 million sheets
3909	Typewriter ribbon	Office	See profile IPS also analyzing 27,000 dozen
3909	Brushes		IPS also analyzing 450,000 pcs.

ANNEX V

PROJECT PROFILES

(Sorted According to International Standard Industrial Classification)

3113 Citrus juice and oils
3113 Dehydration of fruits, vegetables, herbs and spices
3113 Raisin Production
3115 Tallow supply to soap factories
3121 Starch production

3211 Spindle tape for textile production
3212 Terry fabric and towel manufacture

3319 Wooden bobbins and cones for textile industry
3319 Wooden shuttle manufactury for textile industry
3320 Bamboo furniture and woven panelling

3419 Book matches
3420 Pulp moulding

3523 Toothpaste
3529 Animal by-product utilization - particularly bone-meal
3551 Bicycle tyres and tubes
3559 Rubber erasers
3560 Plastic collapsible tubes
3560 Plastic eyeglass frames
3560 Plastic raincoats and other therm•velded products
3560 Tooth brush making

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ANNEX V (cont'd)

3610	Porcelain low tension insulators and ceramic tableware
3620	Pressed and mouth - blown glassware

3710	Foundry for ferrous and non-ferrous casting based on electric induction furnace
3710	Foundry for gray iron castings based on coke/charcoal) Cupola furnace

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3811	Die cast products
3811	Table cutlery and kitchen knives
3819	Back-pack sprayers
"	Fine wire drawing
"	Hand pumps for tyre filling and insecticide spray
"	Heald plates for three fibre factories
"	Pressure cooker
"	Sheet metal work-shop to make such items as AETSC combine harvester parts
"	Small forgings and weldments
"	Solar water heater
"	Television antenna
3833	Electric coffee maker for restaurant use
3839	Flashlight
3843	Automotive Hydraulic tubing and Hoses
3843	Automotive radiator and oil cooler manufacture
3844	Bicycle accessories such as carrier, Rickstand, chainguard and fanders
3844	Bicycle manufacturing

3909	Cellophane tape and paper tape
"	Duplicating stencil paper
"	Insulating tape
"	Typewriter ribbons

3113: CITRUS JUICE AND OIL

Product and uses

Juice is extracted from the fruit for use mainly as a beverage in hotels, restaurants and private houses. It would be intended for the local market.

Oil is extracted as a by-product from the peel of citrus fruits (essential oil) for use in confectionery, perfumery and/variety of other industries. This would be mainly an export product.

To broaden the scope and processing season of the project, it is suggested that other fruits also be considered for juice such as pineappie mango and papaya.

Market Potential

The current market potential for juice is difficult to gauge especially in view of the existance of the nationally-owned Merti Processing Plant, which is just commencing processing of citrus products. It is suggested that any interested entrepreneur investigate Merti's experience as part of his marketing investigation. This investigation would also include a user survey in the urban market, which is expected to be the main consuption area.

Investigation of the international market for lemon/lime oil will require contact with potential buyers. In view of the small quantities involved, it may be advantagous to consolidate this oil with that from Merti if local markets cannot be found.

Capacity

An annual input of 7[illegible] of citrus product is envisaged.

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Process

A small-scale operation can probably not consider full year operation or concentration of juice due to the cost implications.

Since the citrus processing season is only about six months, it is highly desirable that other crops be processed in the offseason to use the equipment more fully and also to occupy the permanent labour force. The Merti plant is processing citrus fruits in an attempt to use the time available during the offseason for tomatoes, their main product.

The process steps are as follows:

- Wash, inspect, weigh and trim fruit
- Extract oil (citrus fruit)
- Extract juice
- Clarify / filter
- Pasteurise juice
- Mix additives
- Bottle/can juice
- Label and box

The residue would be dried as animal feed.

Raw materials

It is expected that the main source of fruit would be from small-holders although state farms could be contacted to judge their interest in supplying also. There is at present no firm idea of small-holder production although effort is currently underway to propagate improved citrus species for small holder and larger farms so production is expected to increase significantly over the coming years. Mapping of the potential suppliers will be essential and plant siting will take this into account.

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Other key concerns in obtaining fruit from the small-holder sector will be the collection and quality control system for incoming fruit.

As noted, efforts would be made to process other friuts such as pineapple, mango and papaya to diversify production and extend the processing season.

Other inputs would be additives such as sugar, acids and preservatives.

Regarding packing materials, careful attention will have to be given in view of the shortage and high cost of cans and bottles Thin-wall blow-moulded plastic bottles with foil-sealed tops may be an alternative. This would however require an initial mould cost. Ethioplastic should be contacted in this regard. Implementation of the proposed national can-making plant could resolve this problem.

Ample quantities of potable water will be required.

Machinery and equipment

- Truck (2 tonne capacity)
- Inspection tables
- Weigh scales
- Oil extractor
- Juice extraction equipment (may vary for different fruits)
- Filter presses/centrifuge
- Stainless steel pasteurising and storage tank
- Bottling/canning line
- Laboratory equipment
- Boiler

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Personnel

Administration	-----	4
Skilled workers	-----	5
Semi skilled workers	-----	8
Unskilled workers	-----	12

Land and building

900sq.m.	Land
400 "	Building

Capital outlay	Birr
Machinery and equipment	350,000
Building	200,000
Working capital	150,000
	700,000

REMARKS

1. The location and availability (timing and quantity) of raw fruit must be confirmed even before a potential plant site can be selected. The collection and quality-control system for fruit especially from small-holders will require careful consideration.

2. Investigation of the local market for juice should take into account the results of the Merti processing plant's experience in a similar venture.

3. The supply situation for bottles and cans is difficult. Thin walled blow-moulded plastic bottles may be a solution.

3113: DEHYDRATION OF FRUITS, VEGETABLES, HERBS AND SPICES

Product and Uses

Dehydrated fruits, vegetables, herbs and spices are items which can be exported to overseas market for industrial and retail use. Dehydration preserves the product and also reduces shipping and handling costs.

Dehydrated foods are also useful in combatting shortages of food domestically during the pre-harvest period and drought conditions.

This profile is a some-what general one which describes mechanical and sun-drying methods of dehydration considered feasible for Ethiopia, mainly for the export market where quality requirements are particularly important. The drying of grapes for raisins is dealt with under a separate profile.

Market Potential

Contact must be made with international buyers to determine required quantities, prices and specifications.

Capacity

The proposed tunnel drier has an output capacity of 400 kg. of onions per 24 hours of operation or 100 tonnes/year operating on a 250 day year if sufficient types of crops allow this.

The use of sun drying can significantly increase this figure at relatively low cost given adequate quality control systems over small-holder output.

Process

Although the tunnel drier system has a higher capital cost, than that for sun drying it is recommended initially, given that consistent high quality can be more easily attained and the plant

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is not as dependent on weather conditions. This also allows future handling of products which require pre-treatment before drying.

As experience is gained the operation can develop the sun-drying activity both to reduce cost of dehydrating as well as to increase through-out at peak dry season harvesting times. Given the involvement of many people at various locations who will require training in processing methods, hygiene and other quality control measures, this process will involve significant extension effort. It is therefore recommended to be instituted on a gradual basis.

The general processing steps for the two methods are as follows (figures given are for drying of onions - other products may differ).

1. Tunnel drying method

- Wash, peel, trim and inspect raw-product. Certain products also require pretreatment before drying such as bleaching, cooking or treating with sulphur dioxide, caustic soda, sugar and/or salt.
- Slice, dice or cut product into strips
- Load on trays on truck (approx 30kg/truck)
- Place one truck in drier approximately every half hour
- Tunnel drier reduces moisture content to about 10% average
- Separate dry material (5-6% moisture) from wet by kibbling machine or rubbing through sieve.
- Dry wet material in a bin drier to 5-6% moisture content.
- Screen and inspect final product (mill if required)
- Pack in moisture proof containers.

2. Sun drying method

This method is suited to material not requiring pre-treatment, other than washing, peeling and trimming. The product should also be able to be cut with a simple hand operated slicer.

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- Wash peel, trim and inspect raw product
- Cut product into slices
- Load on open or covered trays (or possibly mats) separating coarse pieces from standard slices (approx. 3kg/tray)
- Turn by hand once per hour for day 1 and less frequently during the following days until moisture content is about 10% (3-5 days under Nazret conditions). Product must be protected from rain, dust, insects and livestock. Trays are stacked and covered at night.
- Bag and transport product to the central location.
- Inspect, grade and weigh incoming product to prepare for final drying and to determine payment to producers.
- Dry all material in bin drier to 5-6% moisture content
- Screen and inspect final product (mill if required)
- Pack in moisture proof containers.

Raw-materials

One of the key considerations in selecting the types of products besides marketability will be an effort to stagger harvesting times to ensure that the operation can continue over as much of the year as possible.

1. Products not requiring pretreatment

Onion
Garlic
Chili
Herbs such as chives, mint, oreganum, rue, sage, thyme

2. Products requiring pretreatment

Banana(may not need pretreatment)
Carrot
Sweet pepper
Fruit such as peaches, plums, pears, mango, papaya

Turmeric is another product which may be saleable on the export market.

There are many other products which may be dehydrated but their marketability for export is questionable e.g. cabbage, beetroot.

Other material inputs are sulphur dioxide, caustic soda, sugar and salt.

Machinery and Equipment

1. Tunnel drier system (see remark 3)

- Two stage tunnel drier probably electrically heated complete with 12 trolleys, 3 transfer trolleys and 150 trays
- Bin drier
- Inspection and trimming tables
- Vats/cooking equipment for pre-treatment
- Slicing/dicing machine (e.g. Herbot W.Germany)
- Screens/sieves
- Hammer mill
- Final inspection and sorting conveyor belt/table
- Packing equipment
- Washing equipment
- Truck (2 tonne capacity)

2. Sun-drying system

Requirements additional to the above are as follows:

- Vats and brushes for washing
- Inspection/trimming tables
- Hand slicers
- Trays (approximately 1000 - 1250 trays would be required to achieve an output of 100 kgs/day).
- Galvanized iron sheets painted black as solar collectors (optional to shorten drying time and thus reduce no. of trays and stands required)
- Stands for trays (and collector)
- Fencing/mesh to keep flies and insects out.

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Personnel

The tunnel drying system will require most central labour since the peeling and trimming operations are done on-site.

Administration	5
Peeling and training	42-54
Loading and drying section	6
Final drying, inspection, sorting, grinding, packing	3
Others	6
	62-74

The sun-drying system would require the same amount of labour for the last two entries above depending on relative output.

Land and Building

Land (excluding any sun-drying on-site)	$1000m^2$
Buildings	
Tunnel kiln	$50m^2$
Others	$350m^2$

Capital Outlay

1. Tunnel drier system

Machinery and equipment	Birr	80,000
Tunnel kiln	"	50,000
Other buildings	"	100,000
Working capital		Not available

2. Sun-drying system (per 100kg/day out-put)

Trays, solar collectors	5,000

R e m a r k s

1. This project will be more feasible if various products can be processed at different times to ensure as much of a year-round operation as possible.

2. This profile is based on information contained in the following publications which are available in HASIDA.

   - "Sun Drying of Fruits and Vegetables in Ethiopia" by T.H. Jackson and Mona El. Masry of the Food Processing Section, Nazret.
   - "Appropriate Technology for Dehydration of Vegetables and Fruits" by T.H. Jackson.
   - " Low Cost Dehydration of Fruits and Vegetables with a Tunnel Drier" by T.H. Jackson.

3. The basis for the tunnel drier portion is a dehydrating plant built near Khartoum, Sudan producting sweet peppers, onion and other products (see above article).

4. To increase flexibility of operation and profitability this project could be combined with a system which collects and wholesales fresh product to local and overseas markets (by air). Thus the best quality product would be sold fresh and the remainder dried.

5. It is recommended that contact be made with the Horticultural Development Department under the Ministry of State Farms during development and implementation of this project.

3113 : RAISIN PRODUCTION

Product and uses

Raisins made from grapes are a high energy food which can be stored for long periods. They are used alone or as an ingredient in prepared foods and also in wine-making.

There is a large international trade in raising and wider availability in Ethiopia would increase the market here, which is currently served only by high cost imported raisins, beyond the purchasing power of most people.

Seedless raisins are the most common internationally traded version.

Market potential

The following markets are apparent for Ethiopian raisins:

- domestic household consumption (possibly including relief efforts).
- church services.
- wineries (if storage facilities not available for must).
- confectionery makers.
- exports (with aceeptable varieties - probably later on).

At present there is little or no local raisin production although the Horticulture Development Department has conducted trials of various available varieties and with one variety - Tikur - being preferred.

While no formal market survey has been carried out the response to the trial production has been good especially from churches.

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It would be expected that local raisins would be priced lower than imports once significant production is underway, although expected prices have not been determined.

Given State Farm interest in raisin production, the wineries are not considered a potential market for this project.

Capacity

This industry is not seen as one which has specific capacity limitations since the only significant production investment item would be the drying shed which can be increased quite economically.

Given resource limitations, 250 tonnes of raisins would seem a reasonable target in the medium term, to be dried over a period of about 4 months.

Process

To reduce cost of transport in view of the 4:1 fresh/dry ratio, to retain quality and to reduce the size of the central processing facility, it is desirable to do as much drying as possible near the growing sites, probably by the small-holders themselves.

However, with expected initial supplies coming from state farms, the need to refine processing techniques, and the coincidence of one harvest with the rains a combination of small-holder , sun drying hopefully at distant sites and central drying on racks seems appropriate.

In either case the process would be as follows:

- wash grapes with caustic soda (optional) and rinse with water. (oil-water emulsion is sometimes used also).

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- cut bunchs into pieces and lay on trays paper or rack. Cover at night and protect against dust, rain, animals, and humans and also bees (in certain location).
- dry for 12-25 days until moisture content reaches 15%.
- sort good product from stems and rejects.
- package in moisture proof containers.

It may also be feasible to remove the seeds by machine. Fumigation may be necessary to prevent insect infestation during storage - although studies are required.

Involvement of small-holders will require an effective training and extension service by factory personnel as well as government extension officers during the 3 year pre-production period as well as during production.

Raw material

Grapes are grown in the Ethiopian highlands with two crops a year possible between 1200-1600 metre elevation and one per year above that. Five state farms - Zwai, Nura Era, Dukem, Guder and Debre Zeit are the main producers. Although it is planned to increase state farm planting to 1250 ha. from the 73 ha. bearing fruit in January 1985 there will still only be 335 ha. bearing in 1988. From this area production is planned to increase from an estimated 450 tonnes in 1985 to 1700 tonnes in 1988. This production was planned to cater to the wineries which directly import most of their requirement as must or raisins. However, lack of fresh grape processing facilities may mean an excess supply of grapes will exist first for fresh retail sale and then for raisin production. The extent of this potential supply needs further analysis, although there could be oversupply in the major harvest season in January,-March when 65% of the crop is harvested.

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The small holder sector is in an embronic state with woners having only a few vines mainly for personal use. Extension services have not yet been set up for this sector although these are planned to be initated.

Given the relatively short, three years period for commencement of production after planting, it is felt that an interested enterpreneur with appropriate extension assistance could encourage small holder production to the extent desired. Potential production at mid altitudes (2 harvest) of 10t/ha/year and a conversion ratio of 4:1 for Tikur would require only 100 ha. to support 1 250 t/yr. raisin operation. Allowing for lower actual production and inefficiencies only some 200 ha. should be required. This appears to be quite manageable. To extend the season, smallholders in various locations would have to be contracted.

While the Tikur variety seemed best in recent initial Horticulture Development Corp. trials, other varieties including seedless ones are being cultivated and could be utilized also.

Other inputs would be caustic soda (opitional), paper and packing materials. Adequate potable water is necessary at the drying sites.

Machinery and equipment

Washing/pretreatemnt vats
Druong sheds

An Australian model with 10 levels of wire netting under a galvanized sheet roof is suggested. Assuming approximately 25% of the crop would be dried on rack in a conservative 3 months season, with 10Kg. of fresh grapes per m^2 of drying surface and 8 days drying time about 500m^2 of drying sheds would be required.

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Sorting tables/conveyors
Weigh scales
Packaging equipment
Laboratory/testing equipment
Truck
Deseeding machine (if available)

Personnel

(Assuming $\frac{1}{3}$ dried on - site)

Administration	6
Direct labour	
- Skilled	3
- Semi/unskilled	15

Land and buildings

Except for the drying sheds, building requirements are modest landrequirements are quite large, however with scope for future growth and so a rural location would be preferable.

Land	2000m^2
Buildings	
- Office and sorting/store room	300m^2
- Drying sheds	500m^2

Capital outlay

	Birr
Machinery and equipment	50,000
Buildings	
- Office and sorting/store room	120,000
Working capital	Not available (depends on product pricing)

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Remarks

1. As a development project much extension assistance will be required from the Department of Agriculture during both the 3 year vine growing period and production.

2. It is suggested that contact be made with the Horticulture Development Dept. who are conducting growing and processing trials.

3. Since it is felt that small-holder production could eventually form the bulk of input, encouragement by the enterpreneur during the 3 year vine gestation period would be beneficial.

4. For reference see the book General Viticulture by Winkler, Cook, Kliewer and Lider, of U. California Press 1974.

3115: TALLOW SUPPLY TO SOAP FACTORIES

Product and Uses

This profile envisages the supply to soap factories of rendered tallow collected from smaller abattoirs and slaughtering sites to replace imported distilled tallow fatty acid. Given the regional dispersion of the soap factories, there appear to be opportunities for several operations to be organized. There may also be an opportunity for up-grading the refined tallow to compete with distilled fatty acids in higher quality soaps but this option is not explored in this profile. This profile instead assumes that imported fatty acid can be initially replaced in all domestic laundry soap when tallow is processed to a level equivalent to that produced by the Addis Ababa abattoir.

Rendered tallow constitutes 60-65% of the ingredients in soap. Rendered tallow is theoretically 76% of the tallow taken from the animal although practically 60% is considered a reasonable off-take due to the presence of significant quantities of other materials such as dirt, bones, tissue and other materials. Although the remaining 40% may be used as e.g. animal feed supplement, the regional dispersion and questionable sanitary conditions of collection make this doubtful.

Refined tallow also has a benefit over imported distilled tallow fatty acid in that the glycerine is not removed. The Gullele Soap Factory has installed equipment to remove the glycerine from the soap during processing. Glycerine has many uses including being a solvent, plasticizer and sweetener and in the manufacture of dynamite, cosmetics, inks and lubricants.

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Market Potential

The overall demand for additional domestic supplies of tallow is significant given that imported tallow fatty acid in 1983/84 accounted for some 88% of total tallow usage by public soap companies. There is also potential to increase soap production itself in Ethiopia since domestic output only supplies about half the market. It should be noted that inedible vegetable oils can also replace tallow and studies are proceeding at the University of Addis Ababa at the request of the National Chemical Corporation to explore possible domestic sourcing. Excluding this possibility and assuming no change in the proportions of domestic imported product, the total imported tallow thich could be substituted is currently estimated at some 4000 tonnes allowing for the fact that certain high quality soap would continue to require distilled fatty acid. Past imports are shown below

	Fatty-acids, Acid oils from Refining (431.310		Animal fats & oils unprocessed inedible (411.391)	
	Quantity (Tonnes)	Value (Birr 000's)	Quantity (Tonnes)	Value (Birr 000's)
1982	3035	5,010	-	-
1981	3497	3,294	-	-
1980	3534	6,762	-	-
1979	2438	4,123	95	219
1978	603	2,269	-	-
1977	803	1,004	-	-
1976	-	-	843	1140

Source: Annual External Trade Statistics.

The output of the various publicly owned soap corporations and tallow consumption are shown on the attached table.

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Although, marketing conditions have played a part in the factories, inability to produce nearer capacity, a significant factor is the shortage of tallow.

The Addis Ababa abattoir currently charges Birr 1.50 per kg. for rendered tallow.

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Capacity & tallow requirement of soap factories

	Name of the Establishment	Capacity in tonnes		Consumption 1983/84 (E.C. 1976)			
		Potential	Actual of 1983/84 (E.C.1976)	Local tallow		Imported Distilled Fatty Acid	
				Amt. (tonne)	Value (Birr)	Amt. (tonne)	Value (Birr)
1.	Gullele Soap Factory (Addis Ababa)	5,500	3,566	140	240,520	2,120	4,803,920
2.	Nazereth & Arssi Soap Factory	4,100	2,232	530	810,900	1,252	2,786,952
3.	Asmara Soap Factory	2,500	1,267	-	-	751	1,517,424
4.	SAFE (Asmara)	2,500	784	-1)	-	593	1,193,211
5.	IMPI[2] (Addis Ababa)	1,400	1,003	-	-	-	-
6.	United oil mills & Soap (Addis Ababa)	15,000	2,382	100[3]	N/A	760[3]	N/A
				770		5,476	

1) SAFE makes toilet soap for which local tallow is claimed not to be suitable.

2) IMPI cannot use tallow or fatty acid as it produces soap based on synthetic detergent.

3) Local tallow used only for "brown" laundry soap together with soap-stock from oil seed process. "White" laundry soap uses edible oil and imported fatty acid.

N/A - Not available.

Source: National Chemical Corporation (except data on tallow requirement of United Oil Mills & Soap Factory which is estimated).

Capacity

Equipment capacity would vary depending on the number of collection points but would be planned to ultimately replace the imported fatty acid used by a particular factory and assist the soap factory in better meeting its targets.

Since the envisaged rendering equipment is quite simple it will not be difficult to adjust the size to account for the volume of supply in a particular area. The capacity would be such as to cover anticipated fluctuations in supply e.g. Easter, New Year.

Process Description

The required quality of output is assumed to be the same as that of the Addis Ababa abattoir, although its' suitability for replacement of a significant proportion of imported distilled fatty acid needs to be confirmed.

In the Addis Ababa abattoir, crude tallow oil and other liquids are removed centrifugally from a cooked mass of tallow, offal and bones. The oil is separated from other liquids by heating with steam and drawing of the tallow oil. Since tallow only would be processed in the envisaged operation, there should not be a need for this final refining process. It is noted that the Gullele Soap Factory does not do anything more than steam cooking the tallow and drawing off the oil directly for mixing with other soap-making ingredients.

Since the equipment is quite simple under the assumption above the important process parameters are far more those of organization rather than technology.

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The steps envisioned are:

1. Tallow collection

Rendering facilities would desirably be located near major slaughtering areas. For sites further afield the persons collecting tallow would probably do it as a side-line to a regular activity. People who could be suitable are those who butcher livestock for small-holders as well as hide and skin collectors.

2. Rendering

The most economical method would probably be to cook the tallow in vats heated by wood-fires or kerosene. Steam cooking would not be warranted due to the small volumes anticipated at any one rendering site.

While much of the tallow oil would be drawn directly from the cooking vat, a pressing operation would be used to extract the balance.

The tallow would then be filtered and poured into reusable drums supplied by the soap factory for transportation to a storage location or directly to the factory.

The press-cake will likely be discarded although it could be dried, ground and used for animal feed.

Raw materials

Tallow would be mainly obtained from cattle although there would also be some potential from sheep and goats. Production of refined tallow is estimated at 3.75 kg. per head of cattle, based on the Addis Ababa abattoir production figures, although

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this would change with the average size of animal.. Sheep and goat tallow off-take is estimated at 9% and 7% respectively of that of cattle based on relative dressed weights.

Machinery and Equipment

Vat (2 per location)
Kerosene stove (2 per location)
Hand press (1 per location)
Filter arrangement (1 per location)
(These items could be made locally)
Truck with loading/unloading facility
(2 tonne capacity with 4 wheel drive)

Personnel

Manager	- 1
Secretary/clerk	- 1
Driver	- 1
Workers	- 2/3 per site (may be part-time)

Land & Buildings

The buildings at the rendering locations would be very simple open shed construction, fenced for security.

The central office and storage area would be of nominal size as most tallow would desirably be shipped directly to the soap factory with excess stocks stored outside.

Land	
Rendering sites (each)	100 m^2
Central location	150 m^2
Buildings	
Rendering sheds (each)	50 m^2
Central location	100 m^2

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Capital Outlay

Machinery and equipment

Vats press, stove etc.	Birr 8,000 per site
Truck	" 30,000

Buildings

Rendering sheds	" 5,000 per site
Central location	" 50,000

Working capital N/A

(Depends largely on ordering and payment practices of soap companies)

Remarks

1. A key consideration is the logistics of collecting tallow as well as the siting of the rendering sites for the most cost effective handling.

2. Evaluation of this profile will require close co-ordination with the soap companies to work out acceptable quality levels, as well as ordering and payment practices.

3. The potential for further processing of tallow by e.g. distillation into a product which competes with distilled fatty acid in all uses could be considered but is seen as a future step once a basic tallow collection and rendering system is in place.

3121 : STARCH PRODUCTION

Product and uses

Starch is made from a variety of food products including potatoes, cassava, maize, wheat and rice.

It is used in many products but principally as follows:

- foods such as in soups, sauces and desserts
- industrial uses such as textile and paper manufacturing glues.

This profile considers the making of starch from potatoes or cassava as the most suitable for the scale of production envisaged although it is accepted that maize starch, although more complicated in processing, may be preferrd on transportation, storage and availability factors.

The making of starch glue is not considered in the profile due to relatively low usage and lack of process details, but could be considered later as an ancillary industry.

Market Demand

Imports of starches have been as follows:

	Starches of insulin for production of yarns and textile (592.111)		Starches, insulin & others (592.119)		Starch soluble or roasted for textiles (592.253)	
	Tonnes	Birr(000's)	Tonnes	Birr(000's)	Tonnes	Birr(000's)
1982	477	309	15	12	208	308
1981	100	57	34	39	600	370
1980	1280	1207	17	33	253	182
1979	98	56	63	68	117	192
1978	648	435	65	185	100	120
1977	301	192	4	4	132	94
1976	270	143	189	116	-	-

Source :- External Trade Statistics.

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Although there has been much annual variation, average consumption of starch of all types for the years 1976 - 1982 was 710 tonnes/year. While for the period 1978-1982 it was 815 tonnes/yr. The largest apparent user by far was the textile industry.

Preliminary discussions with the Textile Corporation revealed two areas of starch use - sizing and finishing. Finishing can use potato starch although maize starch is preferred for sizing since potato starch weakens the fibres resulting in higher production loss.

The Akaki textile mill reported that 1984 imports were 124 tonnes of maize starch at an average cost of Birr 0.60/Kg. Monthly consumption is estimated at 30 tonnes. This figure should be reconfirmed and consumption figures obtained from the other textile factories together with required specifications.

Although not as significant, the demend from the food and paper industries should also be assessed.

Starch is also used in the production of paper in Ethiopia with current estimated requirement as follows:

Type	Base	Requirement (tonnes)
Size press	Maize	750-800
Corrugated	"	400

There are plans to increase capacity and hence requirement from these levels although estimates were not obtained. The viability of maize instead of potato starch was explained as follows:

- less maize starch required per unit of output,
- quality is better,
- corrugated starch is used in a hot mix process which is easier with maize starch.

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It was concluded however that adjustments could be made to use potato starch.

Capacity

Since starch production from potatoes or cassava is a fairly simple process, it can be operated on various scales, from as low as 200 kg. per day up to 1000 tons/day.

Assuming that potato starches can be adapted to at least part of the textile and paper requirements, a plant on the order of 5 tonnes/day output capacity would appear to be a reasonable size.

Should this capacity prove too large, an alternate description for a simple 200 kgs/day plant is contained in the International Potato Center, Lima, Peru publication. "Simple Processing of Dehydrated Potatoes and Potato Starch" available at the Horticulture Project Offices.

Process Description

The process steps are as follows:

- washing
- peeling
- crushing
- screening
- washing/settling to remove impurities
- sun drying (for a few hours)
- screening/ precision grinding
- bagging

The refuse is dried separately and bagged for animal feed.

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Raw material

The plant would require 35-55 tonnes per day (depending on starch content) of potatoes or cassava. Transportation and provision of storage facilities are especially important considerations for this project in view of the high input volumes requirement. In this regard maize would have significant benefits since it is low in moisture content hence denser and also stores indefinitely. Potatoes can be stored 2-3 months after harvest and a further 2-3 months with application of a sprout inhibitor.

Although cassava and potatoes have not been important crops in Ethiopia, efforts are being made to encourage their use as staple foods. While implementation of a starch project could tie in with these efforts, it must be assumed that the project would have to have significant involvement in the growing process. In Europe potatoes especially high in starch content are grown exclusively for starch production although initially local varieties could be used while such varieties are tested and propagated.

Machinery and equipment

Trucks (2 of 5 tonne capacity)
Weigh scale (2)
Washing/peeling machine
Peeling inspection table
Grinder (4)
Starch extractor
Sieve
Milk tank
Nozzle separator
Packing equipment
Pumps (2) and conveyors (2)
Drying rack
Laboratory equipment
Shallow water tubewell with pump and overhead water tank.

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Personnel

Administration	7
Direct labour	
- Skilled	5
- Semi/unskilled	15

Land & buildings

Land	1,200 m^2
Building	500 m^2

This does not include the large amount of storage which would be required at some point in the delivery cycle (approximately 1.5 m^3/ tonne)

Capital Outlay

	Birr
Machinery and equipment	500,000
Building	200,000
Working capital	200,000
	900,000

R e m a r k s

1. Close coordination has to be made with the major potential users: textile and paper.

2. The establishment of the raw potato cassava growing and delivery system requires analysis to ensure a reliable continous supply and maintenance of proper quality during storage. Introduction of high starch varieties would be beneficial. This area is the key concern of this project.

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3. This profile was drawn in part from profile AB "Cassava Starch Making Plant" in the UNIDO publication. "How to Start Manufacturing Industries", which is available in H.SID..

4. The Horticultural Development Department could be consulted in development of this project.

5. A large-scale starch factory has been proposed as one idea in the Master List of Projects and Programmes under the National Ten Year Perspective Plan.

6. Should the capacity proposed herein prove not to be feasible, an alternate description for a simple 200 kgs output/day plant could be considered as described in the International Potato Center, Lima, Peru publication" "Simple Processing of Dehydrated Potatoes and Potato Starch".

3211: SPINDLE TAPE FOR TEXTILE PRODUCTION

Product and Uses

Spindle tape is used in machinery for manufacture of yarn. It is made of cotton, nylon or a mixture of the two and comes in various width up to 1½ inch although 16/18mm. is the most common. It is delivered in rolls and cut to length at the mills.

Market Potential

Current estimated usage is shown below:

It is understood that the Asmara Textile Mills currently manufacture spindle tape using a knitting process but this is said not to be as desirable as a woven product due to the excessive stretch.

Total identified demand is approximately 630,000m. worth approximately Birr 100,000. Demand for the Kombolcha Mill is not yet established but could be considerable.

Capacity

While this product would be unlikely to justify setting up a new operation especially initially when textile firms will be reluctant to sole-source from a new supplier, it could form a significant part of an operation making other types of woven tape products. Total identified demand would exceed the one shift production capacity of a typical needle loom.

SPINDLE TAPE USAGE

Factory	Product	Estimated Annual Usage (metres)	Cost (Birr/m.)	
Akaki	16mm cot/nylon	125,000	0.14	Import price
Dire Dawa	13mm	33,000	0.17	Import price
	15mm	16,000	N/A	
	22mm	10,000	N/A	
Adei Abeba	16mm cot/nylon	105,000	0.38	Import price
	18mm cot/nylon	10,000	0.32	Import price

Bahr Dar	16mm cot/nylon	200,000	0.1683	
Mener Unifibre	25mm (01/nylon)	34,000	0.15	Import price
	35mm (01/nylon)	20,000	0.10	Import price
Progress Cotton Factory	N/A	39,000	0.213	Import price
Fibre Factories (3)	1" cotton	13,000	N/A	
	1½" cotton	21,000	0.68	
Ethiopian Thread Factory	Nylon	5,000	0.636	Import price
Ethiopian Fabrics		N/A	N/A	
Asmara Textile Mills		N/A	N/A	
Kombolcha		N/A	N/A	
		631,000		

Process Description

Purchased thread is prepared on a warping machine, woven on a needle loom and the woven tape is packaged in rolls of 100 metre.

Raw-materials

Cotton and nylon thread

Machinery and Equipment

Warp preparation machine
Needle loom

Land and Building

Land	200 m^2
Building	100 m^2

Capital Outlay

Machinery and equipment	50,000
Building	50,000
Working capital	20,000

Remarks

While this is a modest project the product does have an easily defined market.

3212: TERRY FABRIC AND TOWEL MANUFACTURING

Product and Uses

Terry is a fabric in which loops, called terry pile, are formed on one or both sides of the material usually from every third or fourth warp thread. The loops are usually left uncut although in certain cases they may be wholly or partially sheared. Terry fabric is usually made into towels although it is also used to make clothing such as house-coats. Various qualities are possible depending on the tightness of the weave, the yarn count as well as the density of the loops.

There are three groups of towels according to design: the figured towel with figures, the dobby towel with small geometrical designs and the plain towel. Terry for garments is usually plain. Fabric may be bleached or dyed in the piece or else woven from dyed or bleached yarn. Although synthetic yarns may be incorporated, cotton towelling is still widely used.

Market potential

Official imports of towels are shown below:

	Towels	
Year	Quantity (dozen)	Value (Eth. Birr)
1982	1,073	65,170
1981	7,141	53,198
1980	460	10,483
1979	14,341	168,921
1978	14,224	418,561
1977	55,447	249,607
1976	--	--

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While these quantities especially in recent times are minimal, towels are reported to be one of the textile items which are also heavily smuggled into Ethiopia. While no figures are known on the import of towels in this manner, it is assumed to be significant since unofficial estimates have been made that the total of smuggled textiles is in the range of Birr 300-400 million per annum.

Good quality towels are also made by Akaki Textile Factory with production as follows, at a current wholesale price less transaction tax of Birr 6.38/m^2

EC 1974	41,460 m^2
EC 1975	41,020 m^2
EC 1976	49,000 m^2

No information is available on terry fabric used for clothing.

While conclusive estimates of demand are not possible, it does appear worth considering production of towels on a small scale as part of an existing textile operation to test the market to see if a larger separate operation is justified. It should also be possible to use the terry looms for other fabrics for increased flexibility of production. Regarding quality, it would seem best to concentrate on the cheaper range of towelling which would not compete directly with those of Akaki Textile Factory or imports.

Capacity

For initial market testing, it is suggested that capacity be limited to that from 2-4 looms pending a better idea of market potential. The output capacity will depend on the type of loom and quality of terry fabric.

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Process description

With the exception of the loom, the process of towel making is very similar to that of other woven textile yard goods. Yarn will be purchased. Dying, bleaching and drying will be done before or after weaving depending or whether goemetric pattern or solid base colours are required.

It is proposed to make only fabric in simple geometric designs or plain colours on the loom to avoid the need for a complex jacquard loom. A silk-screen printing process would be used for figures.

The steps are therefore as follows:

Yarn bleaching/dying (as required)
Drying (as required)
Weaving
Bleaching/dying in the piece (as required)
Drying (as required)
Cutting
Edge sewing of towels
Packaging

Raw-materials

Cotton yarn
Bleach
Dyes
Sewing thread
Silk screens with designs
Packaging material

Machinery and Equipment

Yarn rewinding tying and reaching-in fixtures
Terry fabric loom (3 - 4) - probably power operated but possibility of hand-operated loom should be investigated. To be capable of operation and maintenance by production units presently using standard textile hand-operated looms.
Bleaching /dying/ rinsing vats
Silk screen printing line
Drying machine

Personnel

Direct labour 5-10/shift

Land and Building

Land N/A (part of existing operation)
Building 300 m^2 (excluding warehouse space)

Capital Outlay

Machinery and Equipment	
power looms	60,000-120,000
other equipment	125,000*
Building	150,000*
Working capital	Depends on output.

*Given the small number of looms planned initially, it is essential that most of this equipment and therefore about 50% of the space requirement be in existence already for other production.

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Remarks

1. In view of the undefined market potential, this project is a developmental one. Given this factor as well as its potential applicability to an existing weaving cooperative, it appears HASIDA could play a major part in implementation.

2. A profile for terry towel manufacturing is included in volume I of the UNIDO publication " How to start Manufacturing Industries". However the size of looms (RS 96") and the size of operation (48 looms producing 500,000m^2) is not considered appropriate to present Ethiopian conditions, especially as applicable to Small-scale entreprenurs.

3. A proposal for making towels at the Bahar Dar polytechnic Institute for students was included in the Irish African Friendship Committee Situation Report on Aid Programmes for Ethiopia, July 1984. Proposed specifications for looms and raw materials set out in that report may prove useful.

3319: WOODEN SHUTTLE MANUFACTURING FOR TEXTILE INDUSTRY

Product and Uses

Wooden shuttles are a consumable item used both in the mechanized and handicraft textile sectors. All supplies are currently imported and manufacturing in Ethiopia is considered possible only if appropriate woods can be identified. As a key part of the loom and having to work at high speeds, shuttles must be of high quality.

The shuttles used in Ethiopia are of different sizes but essentially consist of a shaped wooden block up to 60cm. long which carries the weft bobbin and has various metal and sometimes ceramic parts to support the bobbin, guide the thread and protect the shuttle end.

Market Potential

Usage of various models of shuttles is shown on the attached table. It is expected that demand will also increase in the handicraft cooperative sector as HASIDA's efforts to upgrade loom technology bear fruit. Although there are abnormal variations due to special factors such as shortage of raw material and periodic changing of looms, the market is expected to grow at 3-5% per year with the opening of new textile factories.

In view of the particularly heavy requirement for Toyoda shuttles at Dire Dawa, particular study should be made to ensure that any special factors are taken into account. Since output will be for only one industry, it is essential that plans be closely coordinated with the users' plans for future investment and production.

Capacity

The plant would be designed to produce 50,000 shuttles per year in 5 different designs on one shift.

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SHUTTLE USAGE

Factory	Loom Type	Estimated Annual Usage(pcs)	Cost (Birr)	
AKAKI	SAKAMOTO	8000	19.49	FACTORY GATE PRICE
	RUTI	400	35.25	"
	GALILEO	200	36.28	"
	HATTERSLEY	150	51.56	"
	ROBERT HALL	200	29.58	"
DIRE DAWA	RUTI	400	28.43	IMPORT PRICE
	TOYODA	30000	13.50	"
	KOYO	1100	16.54	"
ADEI ABEBA	FEDERLE	120	23.21	"
BAHR DAR	GALILEO	1500	19.78	"
	RUTI	650	34.44	"
	UTAS	200	21.09	"
ETHIOPIAN FABRICS[1)]	PICANOL	300	"	
ASMARA TEXTILE MILLS[1)]	NOTHROP	400	"	
KOMBOLCHA[2)]	CZECH	N/A	"	

1) Up-to-date information not being received yet, these figures are 1978/79 estimates done for the UNIDO project DP/ETH/78/006 Report: Sector Study of the Ethiopian Textile Industry.

2) Under commissioning

Process Description

Shuttles for the mechanized sector are made from wood and various machined steel parts. It is envisaged that this factory would process the wood and install mainly steel parts which would be obtained from worn shuttles from the textile factories, imported, made in house or subcontracted to a local metal shop.

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The process is summarized as follows:

Removal/reconditioning of metal parts from old shuttles
Wood seasoning in kiln
Rough wood shaping
Wood pressing and impregnation with linseed oil(selection of an appropriate species may allow the pressing operation to be avoided)
Wood turning and profile machining
Stamping/forming of metal parts (if not sourced elsewhere)
Assembly

Raw-materials

The most critical raw material is the wood. If wood connot be sourced locally the prospect for a successful project would be substantially reduced. In a study done for the Ministry of Industries NMWC Metal Tools Factory in January 1985, a preliminary analysis of local wood species was made to identify suitable local species for tool handles. The following were considered of suitable quality and in sufficient supply and possibly could be applicable to use in shuttles.

Name	Common name	Gravity Specific	Comment
Olea Africana	East African Wild olive	1.090	Strong & Durable
Dodonea Viscosa	Kitikita	-	Very hard & heavy
Pygeum Africanum	Iron wood	0.818	Fairly hard

Prototype tests would have to be performed using these and possibly other woods before an investment programme could be finalized. The Wood Utilization and Research Centre could be of significant help in choosing species equivalent to those used in imported although outside technical assistance would be essential.

Other raw-materials would be:

Linseed oil phenolic resins
Steel wire and strip

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Specially formed steel and brass parts
Nuts bolts screws
Ceramic tubes (when required)

Machinery & Equipment

Wood seasoning kiln
Hydraulic press (possibly not necessary)
Boiler (possibly not necessary)
Circular saw
Wood turning lathe
Vertical spindle moulding machine
Router
Sander
Drill press
Blade sharpening equipment
Power press 25 ton
Heat treatment furnace
Smithy forge and related anvil and tools
Jigs & fixtures

Personnel

Technical manager	1
Supervision	1
Clerk/accountant	1
Skilled workers	4
Semi & unskilled	8
Guards/helpers	3
	18

Land & Building

Land	600m^2
Buildings	300m^2

Capital Outlay

Machinery and equipment	350,000
Buildings	150,000
Working capital	150,000
	650,000

R e m a r k s

1. A key factor is the acceptability and availability of suitable domestic species of wood. This project could well benefit from experience being gained under a UNIDO project in Vietnam, which commenced activity in April 1985, also dealing with production of shuttles from local species and sourcing of appropriate equipment for manufacture. The project is VIE/80/027/A/01/37, Production of Wooden Accessories for the Textile Industry. Mr. Pietro Borretti with the FAO/ECA/UNIDO Forest Industries Advisory Group for Africa Hall (Tel. 447200 Ext.158) is familiar with this project.

2. As the key shuttle demand is for Dire Dawa's Toyoda loom, usage parameters must be carefully studied.

3319: WOODEN BOBBINS AND CONES FOR TEXTILE INDUSTRY

Product and uses

Wooden bobbins and cones are traditionally used in the mechanized textile sector to wind and store yarn at various stages of manufacture. Plastic has replaced wood in many parts of the world and to some extent also in Ethiopia but it is considered that foreign exchange and labour considerations still justify use of a reasonable quality of wooden product here. Experiments will have to be done to determine a satisfactory type of wood equivalent to the red/copper beech wood used in German production. Only if these tests fail should an alternative solution using plastic be considered.

Bobbins and cones need to be of reasonable quality as to dimension and freedom from cracking or warping but they are not as critical a component as shuttles.

All cones and bobbins are currently imported.

Market Potential

The approximate current demand is shown in the attached table. The totals exclude requirements for the Kombolcha mill since these are not yet known.

Pending further essential study on future plans of the textile industry, it does appear that there is a market for approximately 800,000 wooden bobbins and cones per year worth some Birr 400,000

Capacity

One million bobbins per year or one shift.

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Usage of wooden Bobbin and Cones

Factory	Product	Estimated Annual Usage	Cost
AKAKI	Cheese bobbin	2000	1.56 Factory Gate price
	Cone 5° 57'	10000	1.65 " "
	Weft pirn 220mmx24mm(chocolate)	29000	0.16 " "
	Weft pirn 7"	300000	0.51 " "
	Warp empty 8"	100000	0.35 " "
DIRE DAWA	Kuti weft pirn	6000	0.66
	Toyoda " "	30000	0.85
	Kovo " "	12000	0.66
BAHR DAR 1)	Weft pirn 7"	40000	0.42
	Cone 5° 57'	400	2.25
ETHIPOAN THREAD FACTORY	Cheese bobbin	2000	not available
ETHIOPIAN FABRICS 1)	Pirnwol pirns	24000	Not available
CONBOLCHA	?	?	
ASMARA TEXTILE MILLS 1)	Shuttle pirns	202000	not available
FIBRE FACTORIES 2)	Spool cone	3000	3.60
		757400	

Process

Wood conditioning
(kiln drying may be necessary depending on wood characteristics but hopefully will be avoided)
Rough cutting
Wood turning and boring (semi-automatic)
Make and install steel rings on bobbin ends.

It may be possible to subcontract the making of steel rings to a suitable metal-working shop.

1) Estimated

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Raw Materials

Wood is the prime raw material for manufacture of bobbins. Therefore, the proper type of wood has to be sourced locally. This will require a development programme similar to that for wooden shuttles (3319) although the product requirements are not quite as stringent.

Machinery and Equipment

1) Wood working Lathe
2) Wood working Bandsaw
3) Hand press
4) Shearing machine
5) Drill press
6) Bench planer
7) Sander
8) Set of dies
9) Miscellaneous hand tools and measuring tools.

Personnel

Administration	-----	2
Skilled workers	-----	3
Semiskilled workers	----	4
Unskilled workers	-----	3

Land and Building

Land	-----	400 Sq. m.
Building	-----	300 Sq. m.

Capital Outlay	Birr
Machinery and Equipment	225,000
Building	125,000
Working capital	100,000
	450,000

Remarks

1. The wood raw material will require a development process to ensure its acceptability (see also 3319: Wood Shuttles).

2. Given the common raw materials and customer, it may be worthwhile to combine this project with that of shuttles (3319).

3320: BAMBOO FURNITURE AND WOVEN PANELLING

Product and Uses

Bamboo is a versatile resource widely used in Asia and the Pacific to make many types of articles including houses-both structural and infill components (board and woven panels)- furniture, dividers, mats and basketware. It has also been used for paper making in India, Thailand, the Philippines and China.

Bamboo is of high strength and easily worked while its main disadvantage-attack by insects-can be protected through pesticide application. It is also a plant which regenerates quickly from its roots.

This profile examines some of the possible bamboo products which could be amenable to industrial processing for sale in Ethiopia and eventually for export.

The products considered are:

- chairs, tables-occasional tables and dining tables
- sofa sets
- bedroom sets
- garden chairs and tables
- woven panels and products.

The panels would be woven in various patterns including basket-weave, would be about 2,5 x 0.75m. and composed of bamboo strips 1cm x 1mm.

This project would aim at improved styling and quality to distinguish its products from those made to a lower standard in cottage industries. A knock-down design would allow easier transportation both domestically and for export. Expert design assistance would be required to develop appropriate products.

Small housewares are not considered in this profile as they are generally better made in cottage-industry work-shops.

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Market Potential

Good quality furniture is difficult to obtain in Ethiopia and expensive. Shortage of woods appropriate to furniture production is a major factor. While the supply of veneers is being improved through WUAR, the best furniture uses significant amounts of solids.

The appropriate market for such furniture is considered to be the mid-upper income level Ethiopians as well as expatriates. Given its relatively light weight, strength, and hand-worked appearance, bamboo furniture could be an appropriate article to ship home after a tour of duty. As experience is gained and appropriate unique designs are developed, the export market could be tackled directly although the entrenched competition from Asia would make this difficult. Exports to other African countries under the Preferential Trade Agreement (PTA) could be a more realistic target although small. A target of 300-500 sets per annum initially would appear feasible although market research is required.

Another product worthy of consideration is the bamboo panel woven in a basket-weave or other pattern. These can be incorporated into furniture by the factory as panels, table tops, lamp shades with wood or bamboo used as a framing/support material. Alternatively they could be made into finished panels for partitions, ceiling board or as pressed items. The panels could also be sold in semi-finished form to other manufactures domestically or for export. As a unique item, market potential is difficult to define and would probably have to await sample production.

Capacity

Initial output would be 500 furniture sets per year plus 2500 panels although, since labour is the limiting factor, production could be easily increased.

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Process Description

The process is as follows:

- harvest bamboo and transport to plant
- wash (bleach) apply fungicide & pesticide
- season
- cut structural members to length, cut joints, drill holes
- sand
- slit bamboo for panels and sand
- weave panels
- cut panels to shape
- construct furniture
- finish sanding
- apply fungicide and stain/wax
- make and stuff cushions

Raw-materials

There are two known varieties of bamboo in Ethiopia, a hollow and solid core species. The hollow core variety is located in only a few highland areas and therefore utilization is being discouraged at the present time. The solid core variety, of approximately 2 inch diameter named Oxythanantra Abyssinica, is reported to cover some 450,000 hectares in Welega Region as well as a smaller area in Sidamo region (equivalent to more than 10% of Ethiopia's dense forest cover).

Discussions with Forestry as well as Wood Utilization and Research Centre (WUAR) personnel reveal that bamboo is not being exploited in any organised fashion and no comprehensive studies are known which analyse growth habits and potential for utilization. It is understood that bamboo is widely smuggled into the Sudan and is used to some extent in Ethiopia for housing and furniture. HASIDA operates a training programme for furniture, baskets and other housewares from bamboo.

Studies will have to be undertaken to determine the cost, availability and applicability of bamboo for the uses and volumes envisaged. The incorporation of other indigenous grasses, palm leaves and vines could also be considered.

Other inputs of materials are:

- Glue
- Screws, nuts, bolts
- Upholstery material and thread
- Stuffing material (cotton waste, foam)
- Plywood (for table-tops, seats, panels)
- Stain, wax and other coating material.

Machinery and Equipment

Some small specialty bamboo processing machines are installed at HASIDA's Ethiopian Handicrafts Centre. These were manufactured by the Takahashi Bamboo & Rattan Machinery Works Ltd. of Tatebayashi, Gumma, Japan and sold by Chuo Boeki Goshi Kaisha Central Commercial Co. Ibaraki Osaka-Fu Japan.

The following machinery and equipment is envisaged:

- Soaking, washing vats
- Band saw
- Drill press with drill and mortising sets
- Table saw/radial arm saw
- Bamboo splitting equipment
- Weaving loom (modified textile loom capable of weaving 2mm x 2cm. bamboo strips for panels)
- Belt sanding equipment
- Router
- Jigs & fixtures/layout tables.
- Carpentry hand tools.

A truck is not considered essential initially due to low volumes but will be useful later to transport raw materials and finished product.

Personnel

Administration	5
Direct labour	
skilled	5
semi/unskilled	10

Land and Building

Land	$800m^2$
Building	$500m^2$

Capital Outlay

Machinery and equipment	Birr 200,000
Truck (later)	" 30,000
Building	" 200,000
Working capital	" 300,000

R e m a r k s

1. This is a project with good potential for saving and, in future, earning foreign exchange. In view of the shortage of furniture-quality woods demand should be good for quality products.
2. Technical assistance will be necessary in resource assessment, design development and manufacturing process.

3419: BOOK MATCHES

Product and Uses

This profile concerns production of paper splint standard size book matches, each book containing 20 matches. It is a consumable item used by households and cigarette smokers and is also a useful advertising medium for businesses.

Market Potential

There is currently one nationally-owned match factory producing wooden matches which in 1981/82 (EC 1974) produced 43 million boxes (50 matches/box). This corporation has plans to build a further match factory in Assela with a capacity of 140 million boxes per year.

There have been significant imports of wooden matches as well as intermittent importation of paper splint matches as shown below.

Import of Matches

	Matches in Boxes (899.320/321/323)		Tear off Matches (899.324)	
	Quantity (kg)	Value (Birr)	Quantity (kg)	Value (Birr)
1982	400	5,415	384	4,880
1981	166,990	426,224	-	-
1980	212,674	474,844	-	-
1979	83,264	271,676	95	1,970
1978	61,182	136,775	102	1,166
1977	302,824	591,579	-	-
1976	114,537	348,406	-	..

Source: Annual External Trade Statistics.

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In measuring the potential success of a paper splint match, its merits must be measured against those of wooden matches. These are summarized as follows:

Paper matches	Wooden matches
	1. Already well-known
1. Cheaper selling price (and must be so to compete effectively) (maximum of 5 cents)	2. . More expensive (10 - 20 cents/box)
2. More compact appeal to cigarette smokers	3. . Easier to use when lighting stoves/fires
3. Can be used to carry an advertising message	4. . Good quality local product

Thus it appears that urban dwellers, mainly smokers, are the logical market especially since they also tend to be the market for commercial advertisers. However, given the growth in literacy throughout the country, it is also envisaged that such a mechanism may also appeal to institutional/government organisations who may wish to get non-commercial messages across to the population. Given the strong benefits of wooden matches, it is considered virtually essential that most of the production of paper matches carries an advertising message to keep the selling price down to a point where the wooden match advantages are offset.

Thus an essential element in market research will be contact with potential advertisers both commercial and institutional/governmental to gauge the likely appeal of this advertising medium.

Fifteen million 20 match books or about 15% of 1981/82 usage are seen as a reasonable target.

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Capacity

Fifteen million 20 match books per year on 1 - 1½ shifts.

Process Description

There are mainly two types of safety matches:

- Wooden splint match (stick type)
- Paper splint match

The paper splint match uses less forest resources than the wooden match. The manufacturing process for paper splint type matches is given below:

Comb board - (paper board) is first put into a slitter and friction machine to make match splints. The head of the slitted splints is then dipped into the head composition mixture, in the dipping vat to a 2 to 3 mm. depth. The board frames containing the dipped splints are placed in racks with heads down for drying.

The friction surface for lighting the splint is made by painting a prepared mixture of antimony sulphide, glass powder and glue on the pre-printed paper cover.

The dried comb-board is then stapled to the paper cover and the finished packages are cut to size.

Raw-materials

Paper comb board and cover stock
Glue and ground glass
Lead hydrosulfate
Wax
Potassium chlorate
Phosphorus
Starch, sulphur
Packaging materials;

Personnel

2 - 3 Administration
8 - 10 Skilled worker
4 - 6 Semi-skilled worker
8 - 10 Unskilled worker

Machinery and Equipment

a) Slitter and friction machine
b) Comb match splint and dipping machine
c) Assembly machine
d) Printing press (excluded if cover is purchased pre-printed)
e) Paper cutter
f) Composition grinder
g) Mixer and tanks
h) Kettles
i) Other miscellaneous hand tools
j) Fire fighting equipment

Land and Building

1500 sq.m. land
1000 sq.m. building

Capital Outlay

Machinery and equipment	Birr	600,000
Building	"	200,000
Working capital	"	100,000
		900,000

Remarks

The capital requirements in this industry are large, even for the minimum plant size that is economically feasible. Skilled labour needs are moderate but careful supervision is needed to maintain product quality and for safety. The product has a positive impact through saving of wood resources.

3419: PULP MOULDING PLANT

Product and Uses

Pulp moulding plants are used to make such items as egg-trays, paper plates and containers for retail sale of meat and fish products.

Market Potential

Potential for a pulp moulding plant was discussed in the viability study for the Wonji Paper Mill, Project p1114 Feb. 1984 by Arrow Project Contracts Ltd. This study was done for Ethiopia Pulp and Paper.

The report considered the potential for sales of egg trays and cartons in Addis Ababa where annual production of 21.5 million eggs was estimated to rise to 40 million. Using the latter figure it was concluded that 1,350,000 30 egg trays could be used per year to transport eggs from the chicken farm/grading station to the whole sale/institutional/retail user and that 3,000,000 10 egg cartons could be used for retail sale (75% of total production). The report concluded that while this would require a plant smaller than normal moulding plants, it was economically feasible.

To evaluate the analysis, a visit was made to the Shola Egg Farms, a publicly owned corporation with farms in Addis Ababa and Debre Zeit, producing 30 million eggs per year (with plans to go to 40 million over the next several years). They are by far the major organized producer in Ethiopia with the balance of production mainly by smallholders. Shola uses approximately 100,000, 30-egg trays per year, purchasing these from Kenya at Birr 0.12 each (C&F). Thus each tray is used for approximately ten round trips. They do not use egg cartons at present although they plan to import a sample shipment of the 10-egg size for market trials.

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Based on this information, and assumptions described below the market potential is estimated as follows:

	Trays	Cartons
Shola Egg Farms at 40m/yr	120,000	80,000
Other organized producers	10,000	3,000
Small-holders	-	-
	130,000	83,000
Selling price (Birr)	0.15	0.10 (estimated)
Annual sales (Birr)	19,500	8,300

The estimated usage of egg cartons by Shola assumes that 10% of production will be sold in this manner and that 5 round trips will be made per carton. Nominal amounts have been estimated for other organized producers while there is not expected to be any significant demand from the small-holder segment in the medium term since eggs are traditionally sold loose.

Demand for other items appears minimal at present although the need for trays for pre-packaged meat and fish product sales would follow developments in the marketing of such items. Some further analysis would be warranted to draw firm conclusions in this regard.

Conclusion

The low level of identified demand would not at present justify any significant level of production. The only possibility would be a cottage industry type of operation, although anticipated difficulty in obtaining waste paper for pulping due to the low level of paper consumption and present already high level of reuse make this option unlikely. Therefore it is concluded that development of a pulp moulding operation should be deferred pending market growth.

3523: TOOTHPASTE

Product and Uses

Toothpaste is the most important type of dentifrice used world-wide.

Market Potential

All toothpaste is imported. The following table, for which toothpaste is considered to be the most important constituent, does not indicate a clear trend. Since items in this catagory may be considered as non-essentials, it is likely that foreign exchange constraint significantly affects official imports in particular years. Assuming that toothpaste forms 80% of these imports, average annual toothpaste imports during this period were 45,600 kgs.

Import of Dentifrices, Dental Powder & Mouth-washes (553.050)

Year	Unit	Quantity	Value in Birr
1976	Kg.	273870	756768
1977	"	12301	99892
1978	"	14297	100465
1979	"	7404	68142
1980	"	57647	681083
1981	"	17969	235769
1982	"	15392	515019

Source: Annual External Trade Statistices

Given the population growth plus expected steady popularization of tooth-brushing as compared with traditional methods, a 10% annual growth in demand from a relatively low level does not seen unreasonable. Thus estimated demand in 1986 would

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be 66,800 kgs. of toothpaste. This is equivalent to approximately 600,000, 80ml tubes.

Given an estimated usage of four tubes per person per year, this would give a toothpaste using population of only 125,000 persons or 3% of the urban population. This seems too low. It is therefore recommended that a proper user survey be undertaken to better establish actual demand as well as taste, size preferences.

Capacity

The minimum economic capacity for a toothpaste plant is on the order of one million tubes (80 ml. equivalent) per year per shift based chiefly on the filling machine capacity. Various sizes would be produced.

Thus if the low demand estimates given above are confirmed the plant would probably also be used for other liquid or semi-liquid products sold in the tube form to better utilize capacity. This would probably be mainly in the cosmetic/personal health field including such item as creams and shampos.

Process Description

Manufacturing of tooth paste is basically a formulation process requiring a number of ingredients-abrasive wetting agents, sweeteners, preservatives and additives, cleansing agents, flavour and colours, gems , etc...

The process includes the mixture of different components in stainless steel vats equipped with agitators, filling and packing.

Raw-materials

Distilled water, wetting agent, decay preventive, polishing agent, flavouring agent.

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The main raw material components are as follows:

- Calcium carbonate
- Sodium leyryl sulphate
- Dicalcium phosphate
- Gum acacia
- Clove oil
- Menthol and peppermint
- Oil and salt
- Flavouring agent
- Plastic or aluminum tubes in various sizes.

Machinery and Equipment

1) Stainless steel mixer
2) Storage tanks
3) Distilled water tank
4) Small capacity boiler with pump
5) Tooth-paste filling machine
6) Crimping machine
7) Pump and overhead water tank
8) Weighing scale
9) Laboratory equipment for quality control

Personnel

2 Administrative
6 - 8 Skilled workers (including one technologist and one chemist)
3 - 4 Semiskilled workers
5 - 6 Unskilled workers

Land and Building

Land - 500 sq.m.
Building - 300 sq.m.

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Capital Outlay

Machinery and equipment	Birr	250,000
Building	"	125,000
Working capital	"	125,000
		500,000

Remarks

1. Toothpaste is taken into the mouth and therefore hygiene must be of the highest order.

2. Although a technical license could be obtained from a foreign toothpaste manufacture, the process is not complicated and instead the assistance of an experienced toothpaste technologist could suffice during the start-up period.

3. Although most inputs, except for packaging and polishing agent (possibly), will continue to be imported there will be a significant foreign exchange saving since toothpaste is traditionally a high value added product.

3529: ANIMAL BY-PRODUCT UTILIZATION - PARTICULARLY BONE-MEAL

Product and Uses

This profile considers some of the possibilities for small scale processing of animal by-products from the Addis Ababa abattoir, concentrating particularly on bone-meal.

By-products presently produced by the Addis Ababa slaughter-house are as follows:

- Hides and skins
- Glue from hooves
- Rendered tallow for soap making and glycerin production
- Neat's foot oil from shin bones
- Blood, meat and bone meal for animal feed
- Bone meal from bone, hooves and horns, for fertilizer (minor quantities)
- Handicrafts from horn.

In addition other potential by-products are:

- Bio-gas from stomach and intestinal contents
- Gelatin
- Sausage casing, surgical sutures and sports gut from intestines
- Fine chemicals and medical products from glands and bile

Except for bio-gas generation which has been recommended in an FAO report on Rehabilitation of Addis Ababa Abattoir March 1985 as an activity that the abattoir take up itself as an energy source when a proposed resiting of the abattoir occurs, the other activities are considered amenable to production by auxiliary plants.

The plant currently stockpiles the skulls and brain, most horns, and hooves after boiling for glue. There are ongoing enquiries to overseas companies to purchase the skulls for bone-meal and gelatin production but this has not had results to date.

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In Ethiopia these inputs could be used to make bone-meal and possibly gelatin, the former as a component of animal feed or fertilizer. Gelatin production is not considered in this profile due to planned limited cooking capacity but warrants further consideration.

Market Potential

Market potential for gut production, fine chemical and medical products would essentially be the export market. Intensive contact with potential buyers would be necessary to determine quantity and quality requirements before undertaking such projects.

The market for bone-meal is essentially a local one, although export may also be feasible (but perhaps not desirable from an economic point of view due to Ethiopia's need for fertilizer to replenish depleted soils). It was reported that the Wondo Genet meat processing plant exports its bone-meal.

Discussions were held with the Feed Corporation concerning requirements of bone meal for animal feed. Meat and bone meal are mixed in the proportion of 3-5 kg./100kg. of feed of which the ratio of bone meal to meat meal is 1:9. In recent years there has been a shortfall in supplies of these components as shown below especially with meat meal.

E.C.	Tonnes	Product
1973/74	540.9	Meat and bone meal
1974/75	N/A	
1975/76	599.1	Meat meal
	90.4	Bone meal
1976/77	515.3	Meat meal
	49.7	Bone meal
1977/78	1229.3(target)	Meat meal
	135.3(target)	Bone meal

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It would therefore appear that there is a potential demand for 50-100 tonnes/annum of bone meal at a current purchase price of Birr 401.50/tonne. The reasons for non-delivery by the abattoir itself should be investigated first however.

Cooked bone meal can also be used as an input for China production, although at present there is none underway in Ethiopia.

The prospect for sale of bone meal as fertilizer is less certain at present although potentially much more significant. Little use is presently made of bone meal fertilizer which contains calcium phosphate (16% phosphate in non-refined state) due apparently to concentration on processed diammonium phosphate resulting from past trials which led to general acceptance of this type of fertilizer. Trials will however commence shortly to assess the need for discrimination as to the choice of fertilizer depending on the location and crop. Bone meal will be one of the fertilizers tested. It is noted that natural rock phosphate, a similar product with 25-26% phosphate content, although not imported at present is available from Egypt and efforts are also being made to determine whether local phosphate reserves exist. Price and availability of competitive products should be analysed as part of the market appraisal.

Capacity

Unless considerations noted below justify further processing of bones for fertilizer, the output of required bone meal would be one-half tonne per day (125 tonnes/annum per shift) and that of crushed bone meal for fertilizer 2000 tonnes per annum on two shifts.

Process Description

This profile assumes that the processing cost will exceed the benefits of further processing of bone for fertilizer-through higher selling price, lower transport costs and income from gelatin production. This assumption would have to be checked during feasibility analysis.

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The process is therefore as follows:

Cleaned and dried animal skulls are broken and the brains are taken out and returned to the abattoir. The broken parts of the skull are then dried and fed into a crusher/grinder to reduce to uniform size. These are then fed into the disintegrator followed by feeding into a rotary sieve divided into several sections with varied mesh sieves. Crushed bone of various sizes is obtained and bagged for fertilizer. The finer portions intended for feed or china are then fed into the digester where steam can be injected to make the bone soft and sterile. If finer grades are required, the bone can be reground.

Raw-materials

Skulls, horns, and hooves presently stock-piled by the Addis Ababa abattoir.

Machinery and Equipment

1) Truck (3 tonne capacity)
2) crusher
3) Disintegrator
4) Rotary sieve with different mesh sizes
5) Small boiler
6) Digester
7) Bagging equipment (manual type)
8) Conveyors
9) Carts/wheelbarrows
10) Water pump
11) Miscellaneous hand tools

Personnel

Administrative	2
Skilled workers	5
Semi/unskilled workers	10

Land and Building

Land	1,500 sq.m.
Building	500 "

Capital Outlay

Machinery and equipment	Birr	200,000
Buildings	"	125,000
Working capital	"	30,000
		355,000

R e m a r k s

1. Production of by-products requires close co-ordination with the abattoir especially if products other than bone-meal are contemplated.

2. Potential for this project will probably have to await growth in the market for bone-meal fertilizer. Marketing aspects should be discussed with the .gricultural Imputs Supply Co-rporation (AISCO) who import fertilizers as well as the Agriculture Development Department), Ministry of Agriculture.

3. Although this project assumes sale of bone-meal for fertilizers which has been crushed only, the economics of further refining should be examined.

3551: BICYCLE TYRES AND TUPES

Product and Uses

Tyres and tubes are a frequent replacement item on bicycles. In normal use tyres last about two years and tubes somewhat longer.

Tyres come in various sizes and tread designs with 27 x $\frac{1}{4}$ and 27 x $1\frac{1}{2}$ being the most common sizes.

Market Potential

In the 10 year development plan a large scale bicycle manufacturing plant in the public sector has been listed and is currently under study. If this project is implemented and also a small scale unit is taken up by a private entrepreneur the use of bicycles and hence demand for cycle tyres and tubes will increase. At present all requirements are met through imports.

Import Statistics Table

	Bicycle Tyres (625,400)		Bicycle Tubes (625,912)	
	No.	Value	No.	Value
1982	24,525	131,833	31,859	1,482,314
1981	23,810	93,664	28,704	253,478
1980	33,295	145,793	16,805	410,292
1979	120,807	230,967	30,690	110,837
1978	11,089	30,831	6,560	15,012

Source: Annual External Trade Statistics (1978-1982)

From the table above, it is seen that the average yearly import of bicycle tyres and tubes was in the region of 42705 and 22923 respectively. However the import of these items during the last 3 years (1983-1985) is not known. Import restriction has probably reduced the import of tyres and tubes.

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Taking the proposed bicycle industry production and the existing replacement market of tyres and tubes it is estimated that at least 50,000 tyres and 35,000 tubes can be sold annually.

Capacity

A small unit producing 50,000 each of tyres and tubes a year in a single shift is considered an economic size of plant.

Process Description

A. Cycle tyre

The rubber is compounded on a mixing mill and extended to form the tread strip. The tyre is then built up on the tyre building drum incorporating bias cut fabric, soldered bead wires tread strip and solvent. The tyre is then shaped, removed from the drum and cured in the tyre press with the use of an air bag to produce the proper shape.

B. Cycle tube

Cycle tubes are manufactured by the moulding process. The rubber is compounded in a mixing mill and extruded in the form of a tube. The valve tube is fitted to the tube. The tube is then cut to a definite length and joined by means of a butt joining machine. The tube is then cured in open steam.

Raw-materials

The main raw materials are:

Synthetic rubber
Reclaimed rubber
Nylon tire cord fabric
Stearic acid
Zinc oxide
Carbon black
China clay

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Pine oil and paraffin
Sulphur
Valve fittings
Copper plated bead wire

Most of the raw materials are imported.

Machinery and Equipment

Main machine components:

a) Rubber mixing mill
b) Vulcanising presses
c) Rubber spreading machine
d) Tyre building machine
e) Valve nut tightening machine
f) Air removing machine
g) Mandrels
h) Grinding machine
i) Air compressor
j) Boiler
k) Rubber extruder
l) Various testing equipment.

Personnel

6 - 8 skilled workers
8 - 10 semiskilled workers
4 - 6 unskilled workers.

Land and Building

600 sq.m. land
300 sq.m. covered area (building)

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Capital Outlay

Machinery and equipment	Birr	380,000
Building	"	150,000
Working capital	"	120,000
		650,000

R e m a r k s

The project idea is attractive provided the bicycle manufacturing plants go into production. The production capacity of the proposed plant can be increased should the demand go up. The capital requirements are moderate but skilled labour is needed. Training for the chief technical person will likely be required in an overseas facility.

3559: RUBBER ERASER

Product and Use

Erasers are commonly used for correcting mistakes in pencil and sometimes ink. These are used by students, government offices and commercial establishments.

Market Potential

The demand for erasers is closely linked with the growth of education and industrial development. With the increasing number of colleges, technical institutions, offices and commercial establishments, the market demand for erasers will increase. The government policy of eradicating illiteracy in the country will also open up many new schools, so the future market for erasers is expected to continue increasing.

Although all erasers are imported, the lack of disaggregated import statistics and the likely many importers of such a small item means that it is difficult to make a detailed estimate of demand. It has been found that imports of ETIMEX Corp. are approximately 700,000 erasers per year based on the following table.

Imports of Rubber Eraser
By ETIMEX Corp.

	No. of Boxes	Value C&F(BIRR)	Value LAnded Cost	No. of* Erasers
1982	12,500	48,248	91,953	500,000
1983	-	-	-	-
1984	2,000	8,603	18,765	80,000
1985	-	-	-	-

*Based on ETIMEX figures of 40 erasers per box (Pelican Brand)

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It is estimated that the total demand is on the order of 400,000 erasers although this warrants further investigation. There is future potential also for supply of pencil end erasers to the proposed Ethiopian Wood Works pencil manufacturing plant having a capacity of 26 million pencils per annum.

Capacity

500,000 pieces of erasers annually on a single shift basis. The possibility for supply of pencil - end erasers is not covered in this profile.

Process Description

Natural rubber is commonly used as the basic raw material for manufacturing of erasers although synthetic rubber may also be used.

The manufacturing process consists of the following steps: Mixing various ingredients of rubber compound and moulding the material in the form of desired size and shape.

Palecrepe (natural rubber sheet) is masticated in a mixing mill and then other ingredients are added gradually. After mixing is done sulphur is added to the mixture and the rubber compound in the form of sheet is made. The sheet is then pressed in the moulding press. The moulded sheet is cut into pieces of desired shape.

Raw-materials

Palecrepe
Accelerator
Zinc oxide
Stearic acid
Sulphur
Calcined manganese oxide
Eraser crumbs
Whiting material
Titaniumdioxide
Colouring materials

..../

Machinery and Equipment

1) Mixing mill
2) Hydraulic press
3) Cutting machine
4) Boiler
5) Marking machine
6) Cutting machine
7) Set of testing equipment

Supply of pencil-end erasers would require an extension machine also.

Personnel

3 Administrative
5 Skilled worker
4 Semiskilled worker

Land and Building

Land - 400 sq.m.
Building - 200 sq.m.

Capital Outlay

Machinery and equipment	Birr	200,000
Building	"	100,000
Working capital	"	75,000
		375,000

Remarks

1. The capital and skilled labour for this plant are low, although good management is needed to assure product quality.
2. The growth in literacy will encourage the sale of erasers, as will implementation of the proposed pencil manufacturing plant.
3. In view of the lack of comprehensive information on the present demand situation, further market investigation is warranted.

3560: PLASTIC COLLAPSIBLE TUBES

Product and uses

"Squeeze to use" plastic collapsible tubes are used for packaging a wide range of products such as toothpaste, shampoo, cosmetic creams, lotion, pharmaceutical products, pigments, artist colours, etc. The use of plastic collapsible tubes has become popular due to the fact that they are tough, unbreakable, durable, light weight and less expensive than metallic tubes.

Market potential

Current demand is probably low due to an assumed limited local production of items which could be packaged in tubes as well as the availability of other types of containers on the local market already. These assumptions should be confirmed.

The growth of local production should however continue to be monitored as it is expected that production of the following items will commence in the years ahead. These could be implemented by the National Chemical Corporation - who have included these in their tentative plans, or else by private entrepreneours.

- Shampoo,
- Topical creams,
- Toothpaste.

It is noted that the project on Toothpaste Manufacture (3523) would have a minimum capacity of one million tubes per shift.

The market analysis will include a comparison of costs with other packaging materials.

Capacity

1,500,000 tubes per year in a single shift. The production can be increased should the demand justify by running the plant in two shifts.

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Process description

There are mainly two processes by which polythene collapsible tubes can be manufacture. One is by extending tubes in a hose shape which is cut to the desired length. Injection moulded heads are then joined to the tube.

The other method is the blow moulding process for making the body and injection moulding for the head. The profile is prepared based on the second method.

Polythene granules are heated in hoppers and fed to the automatic blow moulding machine and injection moulding machine. In an integrated operation the tube is formed by blow moulding and joined to the formed head. After release from the mould, the finished tube is trimmed and then printed.

Raw materials

- Polythene granules
- Printing ink and lacquers
- Packing materials

Machinery and equipment

1) Fully automatic mechanically controlled tube moulding press blower machine,

2) Injection moulding machine,

3) Sets of moulds

4) Printing unit,

5) Testing equipment and miscellaneous tools.

Heat sealing equipment will be required as part of the filling operation by the customer.

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Personnesl

Administrative	2
Skilled workers	3
Semi-skilled workers	3
Unskilled workers	2

Land and building

Land	250 sq.m.
Building	150 sq.m.

Capital outlay

	Birr
Machinery and equipment	300,000
Building	100,000
Working capital	50,000
	450,000

R e m a r k s

1. At this time the market would appear insufficient to support an operation of this type. However, with expected commencement of toothpaste, creams and shampoo production, the market for collapsible tubes should grow to a point where production may be considered.

2. As a highly automated process labour requirements are few, although required capital investment is significant.

3560: PLASTIC EYEGLASS FRAMES

Product and uses

Plastic eyeglass frames of various sizes and shapes are made by the moulding process. Eyeglass frames are used as mounts for lenses and sunglasses. This project envisages the possibility of also assembling a cheaper line of sunglasses.

Market potential

Discussion with two opticians in Addis Abeba revealed that there are presently only about eight opticians in Ethiopia selling an estimated 25,000 pairs of prescription eyeglasses per year, all from imported components. Analysis of lens imports indicates a rapid growth in demand over the period 1976-82. (Statistics for frames 884.210 could not be used due to obvious inconsistencies) The main impetus to growth is considered to be the literacy campaign and general emphasis on education which should rapidly increase the demand for eyeglasses in the future.

While it cannot be identified from import statistics, there is also considered to be a market for sunglasses especially among younger people. These would use a frame which by eliminating wire inserts is cheaper than those for prescription glasses.

The fastest rate of growth is expected to be in the lower income sector and therefore it is suggested that concentration initially be placed on more utilitarian designs at least until demand and product quality allows the plant to compete against higher quality imports.

Import of
Lenses, Frames & Complete Spectacles

	Lenses for correcting vision (884.111)		Frames, mountings & parts for spectacles (884.210)		Spectacles for Correcting Vision (884.229)		Spectacles-other * (884.221)	
	Quantity (kg)	Value (Birr)	Quantity (Kg)	Value (Birr)	Quantity (No)	Value (Birr)	Quantity (No)	Value (Birr)
1982	728	142,118	45,776	273,595	14,532	72,246	12,912	22,903
1981	787	122,662	531	60,240	-	-	2,496	89,577
1980	798	122,973	790	210,964	4,092	24,060	15,216	87,945
1979	376	79,760	770	223,051	-	-	5,634	33,348
1978	31	11,036	11,502	161,166	38,364	97,811	4,536	51,180
1977	217	32,605	596	137,818	51,348	168,861	39,516	80,106
1976	299	14,298	7,266	42,089	8,400	14,515	55,140 (+1801kg)	260,707

* 1979 & after - protecting for use in industry.

Capacity

Although in excess of the apparent present market size, capacity could be planned for 50,000 frames per year based on the expected high rate of growth in demand. Inclusion of a line of cheaper sunglasses, although not as profitable, would assist in filling capacity during the first several years of production.

Process Description

Plastic eyeglass frames are made by two different processes:

- Compression molding process where thermoplastic material is used to make plastic eyeglass frames of various sizes and more complex shapes.

- Stamping process for cheaper frames where celluloid sheets are cut in required shape and size for frame front and side parts.

After forming, reinforcing wires are inserted into the side arms by a wire insertion machine. The different parts are polished and deflashed in the buffing machine. All the parts are then assembled and finally polished.

Provision should be made in selecting machinery and equipment for eyeglass frames to be manufactured using both processes to cater for the lower and higher priced market segments.

Raw materials

- Thermoplastic material
- Cellulese nitrate sheets,
- Calcium carbonate,
- Tissue papers,
- Metal hinges and fittings,
- Metal wire,
- Polishing compound,
- Packing materials.

Machinery and equipment

a) Compression molding machine
b) Milling cutter,
c) Riveting machine,
d) Drilling machine.
e) Wire re-inforcement machine,
f) Polishing drum,
g) Buffing machine,
h) Small hand press,
i) Moulds, dies and fixtures.

Personnel

2- Administration
4- Skilled workers
4- Semiskilled workers,
5- Unskilled workders.

Land and Building

Land	300 sq.m.
Building	200 sq.m.

Capital outlay

	Birr
- Machinery & equipment	125,000.
- Building	85,000.
- Working capital is estimated at	90,000.
	300,000.

Remarks

Capital and skilled labour requirements for this plant are relatively small. With the expansion of optical care, literacy and education, the plant will have good prospects.

3560: PLASTIC RAINCOATS & OTHER THERMOWELDED PRODUCTS

Product and Uses

Raincoats are a kind of wearing apparel made out of waterproof material worn over normal clothes during rain. Raincoats are made from a variety of waterproof materials such as cotton, polyester fabrics and other waterproof textiles, sheet plastic, etc. Raincoats made out of sheet plastic have become quite popular because of various advantages such as light weight, easy of folding, availability in colourful designs and low cost compared to other materials. All these characteristics have made plastic raincoats popular throughout the world. Due to the diversified capability of thermowelding machines, in addition to raincoats, the proposed plant can also manufacture a wide variety of other thermowelded products viz, shopping bags, filecovers and folders, purses, school bags, travel kits. Since there is a large scope for further diversification of production in the thermowelding process, a number of other products in various shapes and designs can be easily manufactured.

While the profile has concentrated mainly on manufacturing raincoats, to facilitate taking a decision on other products a separate information sheet is attached.

Market Potential

Very few raincoats (all imported) are in evidence in Addis Ababa with umbrellas apparently the usual method of protection against rain. Therefore, the successful entry of a raincoat on the local market will require an effective promotion campaign and a reasonable price.

However since there are two rainy seasons the potential demand is expected to be significant especially since the price would be much lower than that for umbrellas.

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Capacity

25,000 raincoats per year on one shift.

Process Description

PVC sheet is cut as per pattern, size and design of the raincoat. The different parts are then thermowelded. Zips, buttons, etc. are also fixed by thermowelding and then decorative designs are printed.

Raw-materials

PVC sheet
Buttons, zips, printing ink
Stamping foils and packing materials

Machinery and Equipment

1) Welding machine
2) Cutting table
3) Cutting equipment
4) Screen printing machine
5) Miscellaneous hand tools

Personnel

2 Administrative
2 Skilled workers
3 Semiskilled workers
4 Unskilled workers.

Land and Building

Land - 250 sq.m.
Building - 150 sq.m.

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Capital Outlay

Machine and equipment	Birr	100,000
Building	"	75,000
Working capital	"	50,000
		225,000

R e m a r k s

The product is a consumer item expected to have high demand. Capital and skilled labour requirements for this plant are quite small. Since it is presently an unconventional product it will need initial promotion support.

OTHER THERMOWELDED PLASTIC GOODS

Production Capacity

1. File covers of varies size	- 20000	NOS per year
2. Travel kits	- 4000	"
3. Purses and wallets	- 4000	"
4. School bags	- 4000	"

Personnel (additional)

Skilled	- 2
Semiskilled	- 2
Unskilled	- 3

Additional Machinery & Equipment

1) High frequency plastic thermowelding machine
2) Sewing machine
3) Silk screen printing machine
4) Embossing machine

Raw-materials

PVC sheets of different shades and thicknesses
PVC foam cloth/Rexine cloth
Lining cloth
Zip, fasteners, buttons etc.

3560: TOOTH BRUSH MAKING

Product and Uses

Tooth brushing is the general method used to maintain dental hygiene world wide.

Market Potential

There is no local production of tooth brushes. Since import statistics are unavailable for tooth-brushes, apparent demand is based on toothpaste usage (see profile 3523: toothpaste). It is estimated that each person would use 1-2 brushes per year. The figures in the toothpaste profile give a tooth brushing population of 125000 and thus only 125000-250000 tooth brushes per year. However this appears to be a very low figure when compared to the 4 million urban population.

As also recommended in the toothpaste profile, a user survey should be undertaken to determine actual demand. This is particularly necessary for tooth brushes since the minimum economic capacity is so much larger than the apparent.demand.

Capacity

The quantity appropriate for making tooth brushes is generally said to be about 60 million pieces a year, but here a plant producing 2,400,000 pieces a year, which is the minimum economical size, has been profiled.

Process Description

The tooth brush making process consists of the following stages:

1) Drying of resin
2) Metal mould:
   Tooth brush handles are moulded in the injection moulding machine to various shapes and sizes.

3) Annealing:
The tooth brush handles are cooled in water

4) Separating:
The sprue runner on the moulded tooth brush handles are separated

5) Tufting:
Nylon bristles are tufted onto the orush handle.

6) Trimming:
Ununiform bristles are trimmed in the trimming machine

7) Hot stamping:
Company name, brand name, etc..., are put on the brush

8) Packing:

Raw-materials

Resin (cellulose acetate moulding powder)
Nylon bristle
Brass flat wire
Metallic foil
Packing materials

Machinery and Equipment

The main machinery components are as follows:

1) Hopper dryer
2) Injection moulding machine
3) Metal moulds
4) Annealing bath
5) Separating cutter
6) Tooth brush tufting machine
7) Trimming machine
8) Hot stamping machine
9) Punching press
10) Miscellaneous hand tools

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Personnel

1 - 2 Administrative
6 - 8 Skilled worker
4 - 6 Semiskilled worker
2 - 4 Unskilled worker

Land and Building

Land - 600 sq.m.
Building - 300 sq.m.

Capital Outlay

Machinery and equipment	Birr 250,000
Building	" 100,000
Working capital is estimated at	" 125,000
	475,000

R e m a r k s

As the imputed demand drawn from apparent toothpaste use appears so low, it is essential that a user survey be undertaken to determine the demand more accurately.

3610: PORCELAIN LOW TENSION INSULATORS AND CERAMIC TABLEWARE

Product and Uses

There are a wide variety of electric porcelain insulators which are used in the transmission and distribution of electricity and in telecommunications. The quality and shape of insulators differ depending on end use.

High-tension insulators are used for transmitting electricity along a transmission line from the power generating station to substation while low-tension insulators are used for distributing electricity from a substation to consumers and also for telecommunications.

The proposed project envisages manufacture of low tension insulators in view of the less critical specifications. Various types of simple insulators such as wire holders, spools, lamp holder, fuse holder and pole insulators would be made initially. Later manufacturing could shift toward more complicated products possibly including high-tension insulators.

Raw-material and machinery requirement for manufacturing tableware has similarty to that of porcelain insulators and could justify production in the same plant. Therefore this profile has combined these two products together. Tableware of various types and shapes of plates, dishes, bowls, coffee or tea pots, cups and saucers, milk pots, sugar pots etc are used as household and restaurant items for serving meals.

Market Potential

The Ethiopian Electric Light and Power Authority (EELPA) and Telecommunications Services (TS) were contacted with the following results:

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Corporation	Item	Current Annual Use (Units)	Unit Value	Total
EELPA	Pole Insulator N80	40,000[1)]	1.0[?]	43,056
	" " N95	20,000[1)]	1.37	27,324
	Spool insulators (2 models)	N/A		
	Aerial fuses (3 models)	N/A		
T.S	Pole insulators	20,000[2)]	N/A	N/A

1) Units in 1983/84 purchases in 1982"83 and 1984/85 not available.

2) Estimated based on current plans to install 60 new stations in next 5 yrs requiring 1500 km. of 1 - 2 pr bare wire at 40 - 80 insulator/km

The potential for insulators in Ethiopia would thus appear to be too low to justify a dedicated plant either now or in the forseeable future since assuming 0.25 kg/insulator gives identified demand of only 20 tonnes per year. Although future growth in EELPA's network could raise these figures somewhat, the TS trend towards VHF radio links in lieu of open wires is not promising.

The demand for ceramic table-ware is currently being met mostly by imports as shown below although there is known to be one small plant producing a limited range of table ware.

	Porcelain or China Household ware 666,490		Other domestic pottery ware 666.590	
	Quantity (doz.)	Value (Birr)	Quantity (doz.)	Value (Birr)
1982	11,116	89,560	13,849	127,381
1981	33,087	415,588	147	55,366
1980	408,233	1,021,529	6,998	54,390
1979	744,208	1,093,653	52,307	86,852
1978	2,314,565	1,054,786	26,503	244,081
1977	546,283	628,518	26,962	51,779
1976	673,174	959,000	107,200	199,565

Source: Annual External Trade Statistics

In addition to the above, porcelain water filters have been imported. However the levels during the period are considered too low for consideration of production with average imports worth Birr 13,800 and a maximum of Birr 30,000 in any one year (1978).

Analysis of these statistics reveals a maximum of Birr one million imports of relatively low value items mainly from China, which decreased markedly in 1981/82 probably due to foreign exchange constraints. Since it would not be the intent of this project to compete directly with cheaper ware from China, the potential would be substantially more limited than the levels of 1978-1980 even allowing for some suppressed demand.

From a preliminary view of these comewhat dated figures the market would not seem to be able to support production from the minimum-size plant envisaged. More detailed market research would be required to examine this issue with relation to the current position.

Capacity

40 tonnes of insulators plus 300 tonnes of tableware per year. The latter would be equivalent to approximately 15000 sets of 8 place settings.

Process Description

The manufacturing process consists of the following:

i) **Washing**

Stony materials as feldspar, quartz etc. are thoroughly washed to remove imparities.

ii) **Crushing**

Crushing of stony materials by jaw crusher

iii) **Grinding**

All raw materials are weighed and batched to the required proportion and ground by ball mill.

iv) **Extruding**

The prepared material is mixed in a pug mill and extruded as input to moulding or as a finished shape to be cut to size.

v) **Moulding**

Items are moulded and cleaned of flash. Minor imperfections are repaired.

vi) **Drying**

Drying of product

vii) **Glazing**

Various colours or clear coats are applied. Steps vii) and viii) may be repeated several times.

viii) **Firing**

Firing of glazed item in a tunnel kiln.

ix) **Decoration** (tableware only-optional)

Decoration (printing by hand or pre-printed transfers)is done to enhance beauty and elegance. However this is an optional function to be used for expensive items only. The product is glazed and refired after this step.

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Raw-materials

- China clay
- Quartz sand
- Feldspar
- Fire clay
- Gypsum
- Marble chips
- Glazing materials
- Sodium silicate (tableware only)
- Decorating materials (tableware only)

It is assumed that most of the raw materials are locally available except for glazing and decorating materials although this must be confirmed.

Machinery and Equipment

1) Jaw crusher
2) Rotating screen
3) Ball mill
4) Filter press
5) Vibrating screen
6) Agitator
7) Weighing balance
8) Pug mill with extruder
9) Moulding press
10) Jigger machine
11) Casting apparatus
12) Dryer
13) Glazing accessories
14) Tunnel kiln
15) Laboratory equipment
16) Diaphragm pump
17) Magnetic separator
18) Miscellaneous hand tools

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Personnel

Administrative	- 4
Skilled worker	- 16
Semiskilled worker	- 20
Unskilled worker	- 14

Land and Building

Land	- 2000 sq.m.
Building	- 1500 sq.m.

Capital Outlay

Machinery and equipment	Birr 500,000
Building	" 250,000
Working capital	" 400,000
	1,150,000

R e m a r k s

The minimum economic size of this mechanized operation is quite large for the apparent size of market. Should detailed market research confirm this, it may be more appropriate to consider a cottage-industry level of production. Given the tradition of clay pottery manufacture in Ethiopia, it should be possible to upgrade this with technical advice on ceramicmaterial preparation, mixing, glazing and firing to produce a good quality hand-crafted item.

3620: PRESSED AND MOUTH BLOWN GLASSWARE

Product and Uses

It is envisaged that the proposed plant would produce various fancy glass press-ware such as ashtrays, electric light shades, flower vase, paper weights, finger bowls, salt and pepper sets, jars, jugs and many other glass articles in relatively short runs. In addition specialty small glass bottles for e.g. perfumes can also be produced in this plant. Many other unique glass articles can be manufactured in free-form by the mouth-blowing process as well. Designs can be hand-cut on the items for variety-especially if exports are envisaged. Given the expertise involved, the manufacture of certain laboratory and scientific glassware for school and laboratory use could also be considered.

As expertise is gained, there is a potential for export of unique hand-crafted items.

Market Potential

Other than two glassware manufacturers which mainly manufacture bottles and drinking glasses on an automated basis, there are no small scale glass works currently in Ethiopia. Imports of glassware similar to those envisioned has been as follows:

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	Glassware of a kind used for table, kitchen, toilet, office purposes and for indoor decoration (665.200)		Laboratory and Scientific Glassware (665.811)	
	Quantity (kg)	Value (Birr)	Quantity (kg)	Value (Birr)
1982	50,924	194,415	8,374	248,579
1981	643,695	1,541,226	31,299	304,468
1980	933,698	1,451,165	59,556	521,938
1979	152,869	354,151	49,068	556,778
1978	170,161	531,840	152,284	552,541
1977	219,380	431,714	106,250	247,944
1976	221,709	333,510	30,299	130,773

Source: Annual External Trade Statistics

Although many items could not be manufactured domestically the overall market still appears significant. If local manufacture can be modestly priced, production could also reach a wider range of the population than the imported items do at present.

As expertise is gained, unique free-form mouth-blown and hand-worked glassware could become an interesting export item, particularly if designs unique to Ethiopia such as the coptic crosses can be hand-cut.

Given fluctuating budgets for educational and scientific glassware and the likelihood that only a proportion of such glassware could be made domestically, this is considered as a product line which would be a side-line only.

Although initially only a single plant is recommended, probably in Addis Ababa due to the market, the population of Ethiopia should be able to support one or more regional glassworks.

Capacity

600-800 tonnes of various product mix per year.

Process Description

The raw-materials are mixed together thoroughly in appropriate proportions and fed into the melting furnace. The furnace is heated to a temperature of about 1450 degree C. The molten glass is taken out of the furnace by the help of blow pipes and fed into iron moulds or blown and finished by hand. The articles are removed from the moulds and kept in the annealing oven for cooling where necessary. Designs are then hand-cut as necessary.

Raw-materials

- Silica sand
- Soda ash
- Lime stone
- Borax (imported)
- Feldspar (may be available domestically)
- Chemicals (imported)
- Imported specialty glass tubes and sheet (for laboratory and scientific glassware)

Machinery and equipment

1) Glass melting furnace
2) Annealing oven
3) Press and moulds for pressware
4) Air compressor
5) Weighing machine
6) Hand press for cullet preparation
7) Grinding equipment for cutting of designs
8) Specialty glass-working hand tools
9) Jigs, fixtures and gas torches for laboratory and scientific glassware.

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Personnel

5 - Administration
10 - Skilled workers
10 - Semiskilled workers
18 - Unskilled workers

Land and Building

Land	2000 sq.m.
Building	1000 sq.m.

Capital Outlay

Machine and Equipment	Birr	175,000
Building	"	100,000
Working capital is estimated at	"	75,000
		350,000

R e m a r k s

1. Having no recent artisanal experience in glass-working there is little local expertise in glass-blowing especially by mouth. To launch such a project sucessfully will therefore require strong support by HASIDA in demonstration, training and design activities. Overseas training of the most highly skilled operation such as the glass-blowers may also be necessory.

2. It is considered that the population of Ethiopia could eventually support more than one specialty glasswerks although initially only one plant is recommended, probably in Addis Ababa.

3. Since this operation is labour intension and uses mainly indigenous raw-materials, benefits to the economy will be significent. There is also the future prospect of export earnings.

3710: FOUNDRY FOR FERROUS AND NON-FERROUS CASTING BASED ON ELECTRIC INDUCTION FURNACE

Product and uses

Iron, steel and non-ferrous castings are basic items essential to industrial development both for use as end products e.g. man-hole covers, grates, pipe fittings as well as constituting part of most manufacturing equipment for gears, levers, frames, bushings etc. In the latter case a domestic foundry would cater mainly for the replacement market. Castings can also be produced as input to forging operations for items such as agricultural implements.

While castings can range up to many tonnes, economics would likely dictate a maximum size of 300-500 kg. based on a furnace of similar capacity.

Market Potential

Imports of iron and steel castings and pig iron are as follows. There have been negligible imports of non-ferrous castings.

	Iron & steel castings (#679,000)		Pig Iron (#671,220)	
	Tonnes	Value (Birr 000's)	Tonnes	Value (Birr 000's)
1982	740	1897	-	-
1981	72	285	1014	698
1980	33	99	381	243
1979	1	9	35	35
1978	-	-	11	24
1977	-	-	-	-
1976	-	-	391	172

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There has apparently been a sharp rise in imports of iron and steel castings although the short history justifies caution in interpretation. Local cast iron production was estimated in a 1979 UNIDO report at only some 400 tons annually at 4-5 small private jobbing foundries in Addis Ababa, the Akaki textile mill foundry, the railway foundry at Dire Dawa and two private foundries in Asmara. A foundry is also being implemented as part of the National Metal Works spare parts factory both to feed forging operations as well as to make repalcement castings for public industries such as cement, textiles, sugar, steel factory. Castings at present in Addis Ababa are reportedly of poor quality and expensive. Not included in the above is the 5 ton capacity electric arc furnace of the Ethiopian Iron and Steel Foundry used for steel making from scrap and billets. The report also noted that casting production in Ethiopia is still at a very early stage of development when compared to e.g. 30,000 tons/yr in Iraq and 60,000 tons/yr in Egypt (in 1975). The total demand for iron and non ferrous castings in Ethiopia was roughly estimated at 10,000 tons per year in the same report.

While there may be an element of competition with the proposed public sector foundry, economic development and the desire to save foreign exchange should allow room for both to prosper especially if this foundry can concentrate on short run, high quality parts. Given the market potential, it is likely that this foundry would be situated in Addis Ababa.

Capacity

The nature of the induction furnace allows for a more flexible production schedule than a cupola furnace, for example, and therefore maximum annual capacity is more a function of the size and number of individual castings, which at this point are not identified. It would however be expected that some 300-400 tonnes of castings could be produced per annum in the partial two shift operation.

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Process

It is proposed that the plant be based on an electric induction type furnace for the following reasons:

- Electricity is available while coke (used in cupola furnaces) must be imported.
- Operation is more flexible since various amounts can be melted and a high rate of melting allows quick turn-around.
- Variouscompositions of iron and steel can be melted successfully.
- Quality control is easier.
- While initial machinery cost is higher, this is offset by lower operating costs, a saving in floor area and freedom from pollution.

The process steps are as follows:

1. Pattern preparation - reusable patterns are prepared,probably in wood in a carpentry shop.
2. Sand processing - previously used sand is reconditioned using magnetic separator and breaker screen.
   Fresh sand is added along with additive such as bentonite and molasses.
3. Core and mould preparation - sand is rammed around the pattern in the moulds and after pattern removal, prepared sand cores are placed and the mould closed ready for pouring.
4. Metal melting - scrap iron, pig iron and additives are melted for the particular composition desired.
5. Pouring.

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6. Cooling

7. Casting removal and cleaning - risers, gates and sand are removed from the castings and repairs are made if necessary.

8. Heat treatment is done when necessary.

Raw materials and power consumption

The main raw materials are:

Pig iron (imported)
Scrap iron and steel
Non-ferrous ingots - copper, brass, aluminium
Sand
Sand additives such as bentonite and molasses
Refractories

Power consumption - approximately 650-750 KWH. per ton of metal.

Machinery and equipment

a) Woodworking equipment for pattern shop

- lathe, saw, band saw, belt sander, drill, hand tools.

b) Sand preparation equipment

c) Core oven

d) Electric induction furnace 300-500 kg. capacity

e) Induction furnace or oil fired crucible furnace 100 kg. capacity (for non-ferrous melting)

f) Overhead crane or monorail (1½ tonne capacity)

g) Ladles (100 kg, 500 kg cap.) and hand ladles

h) Moulding machine

i) Wooden core boxes (50)

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j) Heat treating furnace/quenching tank
k) Grinder and pneumatic sand blasing
l) Welder
m) Laboratory and testing equipment
n) Air compressor
o) Sand blasting machine

Labour requirements

	Number required
Administration	7
Foundry engineer-metallurgist*	1
Pattern maker	1
Inspector	1
Direct labour	
- skilled	5 - 10
- semi & unskilled	15 - 20

Land and buildings

Land	2500 m^2
Building	1200 m^2

Capital outlay

Machinery and Equipment	Birr 500,000
Building	" 350,000
Working capital	" 500,000
	1,350,000

Remarks

1. Before an investment decision is made a careful market study must be made through contacts with original equipment/ spares suppliers e.g. AMCE, AETSC as well as other users requiring replacement parts for manufacturing and other equipment.

* Key position.

2. A technical training programme probably overseas will be required for the foundry engineer-metallurgist as well as one or two senior operators in view of the lack of suitable facilities in Ethiopia and the desire for a high quality product. It is also recommended that a foreign consultant be retained during the start-up period and again after some time to assist the foundry engineer-metallurgist, to set up necessary cost control systems and to conduct a training programme.

References

1. "Principles of Foundry Technology" by P.L. Jain Natal Institute of Foundry and Forge Technology, Radchi, India, Tata McGraw-Hill, New Delhi 1979 (in HASIDA library)

2. "Establishment of Mechanical Workshop with Integrated Foundry and Forging Sections" by M.S. Czut UNIDO project DP/ETH/75/008, 15 June 1979. (in UNDP library, Africa Hall).

3710 - FOUNDRY FOR GRAY IRON CASTINGS BASED ON COKE/ CHARCOAL CUPOLA FURNACE

Product and uses

Output would be restricted to gray iron castings, meaning essentially only one composition of metal would be required thus simplifying the production process. Products to be made would be fairly simple and weigh up to 100 Kg. consisting of such items as manhole covers and other drainage pattern investment brackets, parts for agricultural processing equipment, boxes for various purposes as well as small castings for metal working shops.

Market potential

Imports of iron and steel casting and pig iron have been as follows.

	Iron & steel castings (#679,000)		Pig Iron (#671,220)	
	Tonnes	Value (Birr 000's)	Tonnes	Value (Birr 000's)
1982	740	1897	-	-
1981	72	285	1014	698
1980	33	99	381	243
1979	1	9	35	35
1978	-	-	11	24
1977	-	-	-	-
1976	-	-	391	172

There has apparently been a sharp rise in imports of iron and steel castings although the short history justifies caution in interpretation. Local cast iron production was estimated in a 1979 UNIDO report at only some 400 tons annually at 4-5 small private jobbing foundries in Addis Ababa, the Akaki textile mill foundry, the railway foundry at Dire Dawa and two private foundries in Asmara. A foundry is also being implemented as part of the National Metal works spare

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parts factory both to feed forging operations as well as to make replacement castings for public industries such as cement, textiles, sugar, steel factory. The report also noted that casting production in Ethiopia is still at a very early stage of development when compared to e.g. 30,000 tons/yr. in Iraq and 60,000 tons/yr in Egypt (in 1975). The total demand for iron and non-ferrous castings in Ethiopia was roughly estimated at 10,000 tons per year in the same report.

It is intended that this foundry unit, possibly allied with a forging division, would be located in a regional centre other than Asmara and would act in part as a catalyst for related metal-working facilities in surrounding areas. The actual market potential would depend on the particular aspect of the region under study. Given the limited availability of castings at present, market evaluation would have to include careful analysis of this catalyst effect.

Capacity

Initial output is estimated at approximately 350 tons per year based on a one ton per hour furnace operating once per week for a period of eight hours. Since two charges per week are possible, this would permit a doubling to 700 tons per year eventually on a nominal 1-1½ shift basis.

Process

The use of a cupola furnace instead of an electric furnace gives a substantial saving in capital cost although with the disadvantage of higher ongoing labour costs. There is also the necessity to import the coke unless domestic supplies of charcoal prove to be a feasible alternative taking into account forest limitations. The cupola method is also inherently more polluting than an electric furnace but the freedom from reliance on heavy electric lines could allow discretion in final location to alleviate this problem.

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The process steps are as follows:

1. Pattern preparation - reusable patterns are prepared probably in wood in a carpentry shop.

2. Sand processing - previously used sand is reconditioned using a magnetic separator and breaker screen. Fresh sand is added along with additives such as bentonite and molasses.

3. Core and mould preparation - sand is rammed around the pattern in the mould and after pattern removal, prepared sand cores are placed and the mould closed ready for pouring.

4. Metal melting - scrap iron, pig iron and additives are melted for the particular composition desired.

5. Pouring.

6. Cooling.

7. Casting removal and cleaning - risers, gates and sand removed from the castings and repairs are made if necessary.

Raw materials and power consumption

The main raw materials are:

Pig iron (imported) 30 tons/mo.
Scrap iron and steel
Coke 6 tons/mo (imported) (or charcoal if feasible)

Sand

Sand additive such as bentonite and molasses.

Refractories (imported)

Limestone or dolomite.

Machinery and equipment

a) Woodworking equipment for pattern shop
   - Lathe , saw, band saw, belt sander, drill, hand tools.

b) Sand preparation equipment

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c) Core oven

d) Cupola 1 tph capacity

e) Overhead crane or monorail (1½ ton capacity)

f) Ladles (500 Kg. cap.) and hand ladles

g) Moulding machine

h) Wooden core boxes (50)

i) Grinder

j) Welder

k) Laboratory and testing equipment

Personnel

	Number required
Administration	7
Foundry technician - supervisor*	1
Pattern maker	1
Direct labour - skilled	5-10
- semi & unskilled	25-30

Land and building

Land	2500 m^2
Building	1200 m^2

Capital outlay

Machinery and equipment	Birr 300,000
Building	" 300,000
Working capital	" 500,000
	Birr 1,100,000

* Key position.

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Remarks

While there is not such a high degree of knowledge required for a simple gray-iron foundry compared to a plant producing various steel alloy and non-ferrous castings, there will still be a need for mainly practical training of the technician and one or two senior operators, probably in a foreign location. Foreign consultant assistance would be a desirable feature especially for the planning and start-up phases but also periodically for follow-up consultation and training.

References

1. "Principles of foundry technology" by P.L. Jain, Natal Institute of Foundry and Forge Technology, Rodchi, India, Tata McGraw-Hill, New Delhi 1970 (in HASIDA library).

2. "Establishment of Mechanical Workshop with Integrated Foundry and Forging Sections" by M.S. Czub UNIDO project DP/ETH/75/008, 15 June 1979.
(in UNDP library, Africa Hall).

3811: DIE CAST PRODUCTS

Product and Uses

Various aluminium alloy pressure die casting items like building hard ware, door locks, cupboard and drawer knobs and other furnitures locks and handles, automobiles and electrical parts, etc.

Mostly the pressure die castings process is used to manufacture these items. However, many other zince die casting products can also be manufactured by pressure die casting.

Market Potential

Although all die cast items are imported, analysis of trade statistics could not define the extent of demand. Also given the limited time, a market survey could not be undertaken. However it is anticipated that the main areas of demand would be as follows:

- Building construction - mainly window and door fittings, pipe clips.
- Furniture and cupboard builders - mainly knobs and locks.
- Automotive manufacturing/repair companies - mainly AMCE.

Since higher quality dies must be made (and probably imported) for each product, a careful estimate must be made of the demand for each product through contacts with potential users and compared with the die cost.

Capacity

15 - 20 tons of pressure die casting items like door locks, cupboard and drawer knobs and other fancy furnitures handles and locks annually in a single shift. Other house hold items, automobile and electrical simple parts can also be manufactured should the demand justify.

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Process Description

Pressure die castings are made on a casting machine by injecting liquid metal, usually a non-ferrous alloy (aluminium alloy, zinc alloy, etc,), into the cavity of a mould/die under pressure. These castings have a very fine finish and as such do not require much further machining. Generally the quality and design of the castings are required to meet the customer's specifications although various standard items will also be made. The quality of casting obtained by pressure die casting is superior to that of sand gravity casting. Other die casting products can be manufactured by changing the die.

Raw-materials

Aluminium alloy
Zinc alloy
Nuts, bolts, rivets

Machinery and Equipment

1) Pressure die casting machine complete with electric moter etc.
2) Melting furnace (oil fired)
3) Centre lathe machine
4) Drill press
5) Shaping machine
6) Grinding machine (double ended)
7) Bench grinder
8) Miscellaneous hand tools, die set moulds, etc.

Personnel

Administrative	-	2
Skilled workers	-	3
Semi-skilled workers	-	2
Unskilled workers	-	2

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Land and Building

Land - 500 sq.m.
Building - 300 sq.m.

Capital Outlay

Machinery and equipment	Birr	375,000
Building	"	150,000
Working capital	"	125,000
		650,000

R e m a r k s

Capital and skilled labour requirements for this plant are rather small, although good technical supervisory personnel are needed to assure product quality and keep up with the development of new products. So far all die casting materials used in the country are imported from abroad, so market could not be defined but it appears that the project is a developmental one.

3811: TABLE CUTLERY AND KITCHEN KNIVES

Product and Uses

Spoons, forks and knives of different styles are becoming essential items in table service and cooking as western eating habits are adopted. The various types of cutlery envisaged in this profile are tea spoons, soup spoons, serving spoons, dinner forks, dessert forks, table knives, kitchen knives and butter spreaders. In establishments such as hotels, restaurants, hospitals and hostels, table service with such items is customary. The material used in manufacture of table cutlery differs but stainless steel is most common. Both high carbon steel and stainless steel are used for kitchen knives.

Market Potential

At present all requirements of stainless steel cutlery are met through imports, with official imports for 1976 - 1982 shown on the attached table.

From this table, it is seen that the average yearly import of spoons, forks and similar table-ware was 37,269 kg. worth Birr 256,654. Import restrictions have probably constrained the import of these items and so actual demand probably exceeds these levels.

With the growth of urbanisation and population as well as the adoption of a western style of living and food habits, the demand for table cutlery is expected to continue increasing beyond these import levels.

Capacity

Annual output capacity is therefore estimated as follows:

4000 dozen tea spoons
4000 dozen soup spoons
2000 dozen serving spoons.
4000 dozen dinner forks
2000 dozen dessert forks

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Import Statistics Table

	Spoons, Forks & similar Table or Kitchen ware (696,060)		Knives with cutting Blades serrated or not (696,081)		Knives, Blades n.e.s. (696,082)	
	Quantity (kg)	Value (Birr)	Quantity (kg)	Value (Birr)	Quantity (kg)	Value (Birr)
1982	32,062	416,964	1,203	26,585	703	29,796
1981	30,174	223,939	2,446	63,700	273	19,583
1980	28,680	158,663	1,534	33,902	3	110
1979	24,679	182,707	2,303	33,767	52	3,541
1978	51,184	284,496	4,712	47,967	4,370	76,055
1977	55,456	363,708	56,384	197,551	681	9,097
1976	33,649	161,101	-	-	-	-

Source: Annual External Trade Statistics (1976-1982)

4000 dozen table knives
500 dozen kitchen knives of various types
500 dozen butter spreaders

Process Description

The manufacturing process is as follows:

Forks, spoons, table knives and kitchen knives will be hot forged to shape from stainless steel sheet or rod. Kitchen knives are also made from carbon steels. Spoons and forks are then finished by hot pressing, trimming of flash and shaping of fork prongs.

After proper shapes are obtained, grinding, polishing and buffing are done to obtain the shining effect. The pieces are also sharpened and handles are attached as necessary.

Raw-materials

- Stainless steel sheets, rods, etc.
- Plastic or wood handles (as necessary)
- High carbon steel sheets.

Machinery and Equipments

a) 50 ton capacity power press
b) Guillotine shearing machine
c) Trimming press
d) Forging equipment
e) Polishing machine
f) Grinding machine
g) Bench drill machine
h) Hardening furnace
i) Tempering furnace
j) Quenching tanks
k) Buffing machine
l) Miscellaneous hand tools.

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Personnel

Administration	2
Skilled workers	4
Semiskilled workers	4
Unskilled workers	3

Land and Building

Land	300 sq.m.
Building	200 sq.m.

Capital Outlay

Machinery and equipment	Birr	250,000
Building	"	100,000
Working capital	"	100,000
		450,000

R e m a r k s

This is a plant of modest size requiring only a small capital investment and little skilled labour. Table cutlery items are suitable for manufacturing in small scale industry and the project has good prospects.

3819 : BACK-PACK LIQUID SPRAYERS

Product and uses

Back-pack sprayers are used for spraying of insecticides and fungicides in agriculture, public health programmes and household use.

Sprayers may be pressure type or non-pressure. The major parts are a reservor, a pumping action, and a nozzle.

Traditionally sprayers are made mainly from metal (brass, stainless steel or galvanized iron) although plastic materials have become very popular due to resistance to chemicals, light weight and low cost.

There may also be an opportunity for inclusion of a service facility for repair of existing sprayers of various makes which could also aid in promotion of the new sprayers.

Market potential

The import of sprayers is included in the following table.

Sprayers & sprinklers & parts thereof (745-271)

	Quantity (no.)	Value (birr)	Unit value (birr)
1982	18,000	802,780	44.60
1981	37,260	1,062,576	28.52
1980	16,898	2,494,165	147,60
1979	12,969	1,538,009	118.59
1978	8,054	752,459	93.43
1977	7,342	310,091	42.24
1976	-	-	-

Source :- External Trade Statistics.

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The extreme variation in unit values indicates that a number of different products have been imported with variations from year to year. However the overall number imported indicates that economic volumes of several models of back-pack sprayers can be manufactured. A proper market research study will include contact with the major users - Ministry of Agriculture, Ministry of Public Health and Ministry of State Farms as well as an evaluation of potential sales to other public and private users.

Capacity

2,000 back-pack sprayers.

Process

The process will depend on whether plastic or metal tanks are used. If plastic, the tanks would be made at an existing plastic factory desirably from a blow-moulded process. If this process is infeasible then metal tanks would be fabricated in-house. While many of the components may be eventually made out of plastic, initially mostly metal fittings would be used to avoid the high cost of plastic moulds before the market and designs are firmed up.

The steps are therefore as follows:

- Cut and bend sheet metal to shape (metal tank)
- Drill required holes (" ")
- Manufacture special fittings
- Braze/weld tank and tank fittings (metal tank)
- Pressure test (" ")
- Assemble sprayer
- Final test

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Raw Materials

Plastic blow - moulded tank or sheet metal of brass, galvanized iron, stainless steel.

Brass/aluminium/ steel rod and tubing.

Hand-operated flow control valves.

Plastic piping

Miscellaneous purchased fittings - metal/plastic/rubber washers

Including nozzles

Machinery and Equipment

Shearing machine

Sheet bending machine

Swaging, beading machine

Seaming machines

Press

Lathe machine

Milling machine

Drill press

Double end bench grinder

Gas welding set

Tools, dies

Hand tools

Personnel

Administration	4
Direct labour	
- Skilled	2
- Semi-/unskilled	4

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Land & Building

Land	500 m^2
Building	250 m^2

Capital outlay

	Birr
Machinery and equipment	300,000
Building	125,000
Working capital	100,000
	525,000

R e m a r k s

1. This profile envisages manufacture of plastic or metal tank based back-pack sprayers for agricultural and health use as well as a repair facility for existing sprayers with resulting economic benefits to the country.

3819: FINE WIRE DRAWING

Product and Uses

Fine wire of various metals including steel, copper, aluminium and brass is used in many applications such as the following:

- Staples and clips
- Small springs
- Hair pins and curlers
- Armature winding
- Continuous welding electrode
- Wire cord
- Copper/aluminum electric and telephone wire and cable
- Fencing light mesh
- Nails
- Tie wires
- Wire cable for supporting telephone poles and fastening loads in trucks.
- Hinge wire

As noted under Market Potential, it is not contemplated to manufacture fencing and mesh wire, nail wire, coated electric copper wire or cable of any type - although the latter product requires further analysis.

This plant would produce cleaned, annealed ferrous and nonferrous fine wires.

	Iron & steel wire except that imported for futher processing (677.019)		Stranded wire cables, cordage, plaited bands slings and the like of iron and steel (693,110)		Stranded wire etc. of copper alloys (693.120)		Stranded wire etc. of aluminum (693.130)	
	Quantity (Kgs)	Value Birr	Quantity (kgs)	Value Birr	Quantity (kgs)	Value Birr	Quantity (kgs)	Value (Birr)
1982	528,124	715,188	445,471	2,347,274	44,723	251,220	499,218	1,845,415
1981	615,754	899,913	93,013	276,155	6,525	41,273	669,368	2,463,733
1980	667,450	1,197,371	234,643	737,908	9,292	115,493	44,861	197,925
1979	265,283	417,7[illegible]	89,067	438,667	7,547	53,252	8,908	48,546
1978	75,159	21[illegible],345	51,973	185,350	523	9,425	43	1,060
1977	761,781	632,820	253,313	594,150	1,173	4,293	-	-
1976	65,371	38,213	214,792	560,617	4,804	31,350	1,215	4,620

Source :- Annual External Trade Statistics

Market Potential

The attached import statistics provide a break down of finished steel wire (i.e. not imported for further processing), steel cable, aluminium cable and ferrous cable. There are no import figures available for finished non-ferrous wire and these are assumed to be minor. Statistics (not attached) are also available for imports' of steel wire and copper wire for further processing, most likely by National Metal Works and Ethioplastic respectively.

Copper electric wire, fencing wire, light mesh and nail wire are currently made by public industries and barring rationalization of production or significant private manufacture, are unlikely to be made under this project. It may be possible to import semi-processed wire for further treatment before processing by the public industries, but this requires analysis especially with Ethioplastic.

Import figures indicate a steady demand of approximately 500-600 tonnes of finished steel wire. As to usage, staples, clips, and wire usage are easily identified requirements since they are products known to be made in Ethiopia. However, given the total tonnage, there must be numerous other users. Therefore a market survey is required to determine the future requirements of all major users both as to tonnage, size finish and treatment. (See Annex I, sub-sector review section 38 for NMWC requirements)

Imports of cable would appear to be on the order of 200-250 tonnes of steel and 200 tonnes of non-ferrous cable, mostly aluminium, although great variation from year to year is observed. The use of aluminum and copper cable is expected to be mostly for electricity and telecommunications and therefore relatively easy to determine. However, like steel wire, steel cable probably goes to a variety of users and therefore a more detailed market survey would also be required for this product sector. Of course, without a cable making plant, which does not currently exist except for electric cable at Ethioplastic, these requirements cannot be addressed in a wire-drawing plant.

Capacity

The plant would have a capacity of approximately 400-500 tonnes per year on two shifts. This capacity is only approximate since it depends heavily on the sizes produced which can therefore only be set when the market analysis is completed.

Process Description

This process produces degreased and deoxidized annealed steel and non-ferrous wire i.e. without coating or specialized heat treatment. Should the market appraisal show that significant quantities of specially treated wire are required, then additional equipment will probably be necessary. Surface coating (e.g. galvanizing) would be applied in a fairly simple continuous process through a tank while heat treatment would best be done in a furance, although a continuous process is possible for high volumes and for certain types of simpler heat treatment.

The steel wire drawing process consists of the following steps:

Mild steel wire rod in 6 mm. coils is drawn in a multi-staged continuous wire drawing to produce the desired diameter size of wire. The wire drawing process involves intermediate stress relieving. The drawn wire is then annealed in electrically heated chamber, degreased, cleaned and dried.

Nonferrous metal wire drawing:

Nonferrous metal wire (e.g. copper) rod in the form of coils of 9mm. diameter is processed first in a bull block to a lesser diameter. of about 3mm. diameter. Then it is further drawn in a continous multi-stage drawing machine to 1.2 mm. or less as required. The drawn wires are annealed in a furnace and then put through a deoxidation process if required.

Raw materials

- Mild steel wire 6 mm. diameter
- Copper wire rod 9 mm.
- Aluminium with rod 9 mm. diameter

Machinery and equipment

1. Wire drawing bull block machine (9mm. to 6mm.)
2. Continious multistage wire drawing machine (6mm. to 3mm)
3. Continious multistage wire drawing machine (3mm. to 1.2mm.)
4. Annealing furance electrically heated.
5. Degreasing/pickling Tanks with electric heating arrangement.
6. Continous wire galvanizing line (if required)
7. Measuring tools, dies, and equipment.

Specialized heat treatment facilities are not included due to their high cost and uncertain requirement pending detailed market analysis.

Personnel

Administrative	3
Skilled workers	4
Semiskilled workers	3
Unskilled workers	4

Land and Building

Land	600sq.m
Building	400 "

Capital outlay	Birr
Machinery and equipment	400,000
Building	150,000
Working capital	100,000
	650,000

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REMARKS

1. A detailed market analysis is required before preparation of a feasibility analysis since the many possible specifications (size, surface finish, heat treatment) and volumes must be determined before equipment requirements can be drawn up.

2. In considering this profile an effort was made to include a facility for making of steel and non-ferrous cable to both broaden the scope to include higher added value items and increase the tonnage of wire which could be put through the wire drawing process. However, the identified tonnage of 200-250 tonnes/year. steel cable and average, although highly variable, non-ferrous cable requirement of some 200 tonnes/yr. would seem to be insufficient to justify the expected large investment for wire treatment and cabling equipment. This conclusion requires confirmation through more detailed analysis.

3819: HAND PUMPS FOR TYRE FILLING AND INSECTICIDE SPRAY

Product and Uses

This profile combines two sprayers which although having different purposes require similar manufacturing processes and for which individual quantities will be modest initially.

Tyre pumps are used for air filling in tubes of motorcycle, automobile vehicles and bicycles. Since in rural areas and during transit, air filling facilities are not available, tyre pumps are widely used.

Simple hand pump sprayers are used in households and other areas for insect, fungus and disease control. They are comprised of a pumping action, reservoir and spray nozzle.

Market Potential

As the following table shows, import of bicycle pumps appear to be minimal although it is suspected that many pumps enter the country with bicycles or as part of shipments of bicycle accessories. Since pumps are long-lasting there is not a significant replacement market. Pumps may however be used not only for bicycles but also for car and motorcycles especially in rural areas.

While there may be limited sales elsewhere, the main demand for bicycle pumps will come at the time of start-up of the large scale national bicycle manufacturing plant (currently under study) or the small-scale bicycle project envisioned in these profiles.

Bicycle Pumps (743.111)

Year	Qnty(No.)	Value(Birr)
1976	-	-
1977	580	1,647
1978	2,240	4,725
1979	-	-
1980	1,310	17,245
1981	964	3,683
1982	1,200	7,370

..../

Regarding insecticide spray pumps, there are efforts to introduce pyrethrum (natural insecticide) growing in Ethiopia. If this initiative is successful an opportunity could arise for the manufacture of simple hand-held pump sprayers for insect control in the home and for other small-scale uses, thus avoiding the need for expensive imported aerosol ingredients.

Capacity

Manufacturing a total of 25000 pumps per year appears to be an economical unit. Production can be easily increased from these levels.

Process Description

Steel tubes are cut to size and threading is done on special fixtures. Mild steel rods are turned on lathes and threading is done at both ends. Top and bottom fittings are machined on a lathe. In order to keep the costs down, it is proposed to purchase nuts, bolts, leather washers, springs, rubber/plastic tubes etc. from out-side. All these parts are assembled to form the pump.

For the insecticide pumps sheet metal reservoirs are formed, seamed, soldered and joined to the pump section.

Raw-materials

The main raw materials are:

- Steel sheet
- Steel tubes 30mm
- Steel bar 10mm
- M.S. nuts and washers
- Leather washers
- Rubber pressure tubes
- Springs
- Nozzles, piping

Machinery and Equipment

a) Lathe machine (small)
b) Tin-plate rolling machine (hand)
c) Seaming machine (hand)
d) Drill machine
e) Threading machine
f) Hand press
g) Metal cutting circular saw
h) Grinder
i) Workshop tools etc.
j) Soldering equipment

Personnel

2 Administration
3 Skilled worker
4 Semiskilled worker
3 Unskilled worker

Land and Building

Land	600 sq.m.
Covered area (building)	200 sq.m.

Capital Outlay

Machinery and equipment	Birr	150,000
Building	"	100,000
Working capital	"	50,000
		300,000

R e m a r k s

The project idea is attractive as the product would be an ancillary item of the proposed bicycle industry. This dées mean however, that, given the minimum economic volume of 25000 units, start-up will likely have to await that of the large scale bicycle plant, depending on success with the insecticide sprayes.

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3819: HEALD PLATES FOR THREE FIBRE FACTORIES

Product and Uses

The heald plate is used in the jute fibre factories to raise and lower the warp thread during the weaving operation.

Two similar designs are used both made from 20 - 22 gage spring steel of dimension 1cm x 21 - 23cm. with a ring brazed in the middle.

Market Potential

Discussions with the Ethiopian Fibre Factory personnel revealed that current usage is on the order of 16,600 pcs. at Birr 0.55 each. However the investment plan for the three fibre factories to newer looms over the next 2 - 3 years is expected to increase this to 91000 pcs.

Capacity

This item would be produced in an existing metal working shop due to its modest overall value.

Process

Tempered spring steel strip is cut to length, slots are punched and minor bends formed. They are then brazed to a preformed ring and the assembly is electroplated, the latter probably subcontracted.

Raw-materials

20-22 ga x 1cm. tempered steel strip in a coil form
m.s. wire.
Soldering/brazing materials.

..../

Machinery and Equipment

Except for the simple dies, this equipment would probably be on hand.

Press and three dies
Brazing equipment
Electroplating equipment - (probably sub-contracted)

Labour Requirement

It is estimated that one person could produce the volume anticipated.

Land and Buildings

Nominal space requirement only in an existing work-shop.

Capital Outlay

Assuming electroplating is subcontracted the outlay would consist only of the die cost which should be modest.

R e m a r k s

This is a project for an existing metal-working shop and should have a high value added.

3819: PRESSURE COOKER

Product and Uses

Pressure cookers are a kind of vessel (utensil) extensively used in households for cooking food. Pressure cookers have advantages over conventional cooking utensils due to its capacity for retaining the flavour of cooked food and also requiring less time for cooking and thus saving considerably on fuel especially in high altitude such as those of Addis Ababa. They would be used mainly for cooking the meat, vegetables and sauces accompanying enjera.

It is a closed cooking vessel for use on a stove or fire, capable of producing a steam pressure of 1kg/cm sq. The capacity of the cooker with the lid fastened varies from 3 to 8 litres, although pressure cookers of 3-5 litres capacity are the most popular. This product is widely used in similar conditions in India and Afghanistan and it would be worthwhile for an entrepreneur to obtain such a cooker for development purposes.

Market Potential

Since pressure cookers are only currently available in small quantities and at high prices, they are only rarely used except by the expatriate community. It is felt however that of a pressure cooker with a modest selling price of some 70 Birr can be developed and if its advantages (especially in saving of cooking time and fuel saving) can be properly demonstrated, there is the potential for development of a significant market. The rapid market development of the enjera cooker costing substantially more is seen as an example of what could happen with this product.

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Capacity

Capacity is set at about 5000 units on one shift which could be increased by additional shifts should demand require.

Process Description

The various parts required for the manufacture of pressure cooker and the raw materials used, are given below:

1) Body and lid - Aluminium alloy high strength plate
2) Container - Aluminium alloy sheet
3) Plug -
4) Gasket - Heat resistant synthetic rubber
5) Grid - Aluminium alloy
6) Handles - Non-flamable bakelite
7) Pressure regulating value - Stainless steel
8) Pressure regulating pin - Stainless steel
9) Tubes - Brass or stainless steel

The main operations consist of the following:

- Circle cutting
- Drawing of body of cooker
- Drawing of lid
- Trimming and Notching of body and lid
- Drilling of holes in body and lid
- Fixing valves, handles and vent tube
- Pressure testing and polishing.

Raw-materials

Imported aluminium alloy sheet is the main raw material. Handles, pressure regulating valves gaskets etc. would be imported initially although local manufacture of some parts is anticipated in future. Pressure cookers develop much higher pressure than ordinary cookers, so it is necessary to take sufficient precaution in the manufacturing process to safegurd against accidents to the user.

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Machinery and Equipment

a) Shearing machine
b) Circular cutting machine
c) Drawing press with dies
d) Hydraulic press 40 - 50 ton capacity
e) Power press - 50 ton capacity
f) Lathe machine
g) Drilling machine
h) Grinding machine
i) Testing equipment :- Pressure tester, Air leakage tester.

Personnel

Administrative	- 3
Skilled worker	- 4
Semiskilled worker	- 3
Unskilled worker	- 3

Land and Buidling

Land	- 450 sq.m.
Building	- 300 sq.m.

Capital Outlay

Machinery and equipment	Birr 200,000
Building	Birr 100,000
Working capital	Birr 100,000
	400,000

R E M A R K S :

1. Capital and skilled labour requirements for this plant are relatively low and could appeal to an

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entrepreneur as a single project of his own or could be combined with a related product as for example, aluminium/enameled utensil manufacture.

2. This project will be of significant economic value to the country since it will assist in conservation of fuel.

3819: SHEET METAL WORK-SHOP TO MAKE SUCH ITEMS AS AETSC COMBINE HARVESTER PARTS.

Product and Uses

This profile envisages the setting up of a sheet metal work-shop to make mainly spare parts and assemblies for existing industries. The particular opportunity chosen is the spare part requirements for combine harvesters imported by Agricultural Equipment and Technical Services Corporation (AETSC) from the GDR and Yugoslavia. While this would be a significant portion of the work, it would likely be necessary to do sheet metal work for other customers to make a viable unit. This could be in areas such as farm and industrial tanks, tractor spares and office equipment. Eventually the unit could also sub-contract sheet metal work from the Nazret tractor assembly plant when it commences production of combine harvesters.

Market Potential

AETSC sells two models of combine harvester with total sales over its five year history shown as follows:

Source	Model	Quantity
GDR	E512	158
Yugoslavia	141	117
		275

Although there are many different sheet metal parts procured for combine harvesters, the attached list for the GDR combine harvester is limited to those parts which appear to be used in sufficient volume to warrant the cost of jigs, fixtures and time involved in setting up for manufacture. The table and item numbers on the list relate to the illustrations attached while volumes shown are those for the year July/83 - July/84 for model E512.

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Time did not permit a similar analysis of the Yugoslav unit but based on the relative number of units sold and assuming a similar cost structure, it is estimated that comparable parts worth some Birr 180,000 would be used per year for model 141.

Production of combine harvesters at the Nazret plant would create a significant demand for sheet metal products, far greater than the present spare parts demand since it is ultimately planned to produce 400 units per year. The present uncertainly over timing of implementation would not however justify setting up a sheet metal work-shop at this time to cater for this size of operation. Developments in this area should continue to be followed.

GDR COMBINE-HARVESTER MODEL E-512

Item	Table No.	Item No. on Table	Part No.	Qnty.	Unit price (Birr)	Total price (Birr)
Steering axle	8	18	5550 10 0550	10	894	8,940
Beater trough	11	1	5550 54 0011	17	1247	21,199
Vibrating tray	16	1	5550 56 0012	30	1031	30,930
Vibrator liner	16	2	5550 56 0120	52	28	1,456
" "	16	3	5550 56 0130	31	25	775
" "	16	18	5550 56 0140	30	28	840
" "	16	19	5550 56 0150	32	24	768
" "	16	4	5550 56 0180	34	21	714
Flap sleeve	19	4	5550 57 0030	13	829	10,777
Fan wheel	21	1	5550 59 0012	32	666	21,312
Fan blade	21	2	5550 59 0221	180	57	10,260
Blower housing-lower part	21	5	0202 79 3670	35	554	19,390
Blower housing-upper part	21	6	5550 59 0030	40	413	16,520
Housing	22	1	5550 60 0011	30	813	24,390
Worm for ears	22	3	5550 60 0480	26	233	6,058
Housing	23	4	5550 62 0600	41	472	19,352
Guide rail	23	5	5550 62 0760	35	183	6,405
Worm	28	1	5550 67 0760	12	200	2,400
Discharge tube	30	1	5550 68 0010	13	646	8,398
Worm	30	2	5550 68 0020	13	555	7,215
Auger	60		5557 02 0012	9	3036	27,324
						245,423

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Capacity

The minimum capacity is not quantified but would be significantly more than that required for the combine harvester parts requirements alone especially since detailed analysis would probably result in certain parts being excluded from consideration.

It is estimated that projected annual sales would have to exceed at least Birr 500,000 to make this project worthy of consideration.

Process Description

The process will vary slightly for different parts but is generally as follows:

Cutting sheet to shape
Bending/drilling/ tapping
Turning of special parts
Welding
Degreasing
Painting

Raw-materials

Galvanized m.s. sheet - various thicknesses
Bar stock m.s. - various profiles
Paint
Welding gas
Nuts/bolts

Machinery and Equipment

Shear
Power hacksaw
Hand operated rolling machine
Power nibbling machine
General purpose lathe
Spiral forming machine

..../

Punch presses 1-10 ton, 1-20 ton
Drill press
Double wheel pedestal grinding machine
Oxy-acetylene welding set
Spray paint equipment and paint booth
Spot-welding equipment
Anvil
jigs, dies and fixtures
Hand tools

Personnel

Manager/supervisor	- 1
Secretary/clerk	- 1
Accounting/purchasing clerk	- 1
Direct labour	
- skilled	- 4
- semi and unskilled	- 8

Land & Buildings

Land 600 m^2
Building 250 m^2

Capital Outlay

Building	Birr 100,000
Machinery & equipment	" 250,000
Working capital	" 125,000

(Based on sales of Birr 500,000/Yr)

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Remarks

1. Given the large investment in fixed assets relative to the sales potential to ATSC, it will be essential to identify sales of sheet metal products to other customers before making an investment decision.

2. Since the market for combine harvesters is expected to continue to grow, especially when the Nazret production of combines commences, the shop will eventually be able to concentrate entirely on such parts.

3819 : [illegible]

Product and Uses

Small forgings and weldments are used in various industrial applications where more strength is required than provided by castings.

Market Potential

In this pin the following user/uses are identified although actual volume of usage has not been confirmed in most cases.

[illegible]	: Mostly forgings as weldments are made in heavy steel as: - truck body hinges, - cable tie pulleys and winches.
[illegible]	: Forging potential limited to high production item i.e. - ripper for cutting bar on crawler [illegible] (3,280 pcs. at Birr 9.62 consumed in latest year).
Nazret Tractor Factory	: Various forgings/weldments not specified. (This is a future need since tractors are import in CKD form presently).
Building supply industry	: heavy duty hinges as fittings, other weldments and forgings are used by various industries largely on a custom basis. Due to the cost of dies, the potential for forgings is probably limited.

In view of the relatively limited demand at present, it is recommended that this profile be considered as part of an associated project such as a foundry or other metal working operations.

Capacity

It is difficult to quantify the volume of work since these items would be produced in an existing foundry shop mostly as a job shop type of production.

Process description

The process will vary slightly for different parts but is generally as follows:

- Cutting metal plates to shape and size by gas welding.
- Heating, pressing and machining of M.S. bar stock to required profiles.
- Welding.
- Heat-treating if necessary (may be sub-contracted)

Raw materials

M.S. plate of various thickness.
M.S. bar stock of various thickness.
Welding gas
Welding electrodes.

Machinery and equipment

The following machinery would be required for making of general furnaces and elements. Since this is a project for an existing foundry and/or metal-working shop, most of the equipment would probably already be on hand.

1) Column type power press (50 tons)
2) Guillotine shearing machine.
3) Blacksmith forge with hearth and hand, anvil, etc...
4) Hand tools, bench tools, forming dies, etc...
5) Gas and arc welding sets.
6) Hand grinder.

.../

a) Heat treatment furnace and machine tools.

b) Quenching tanks.

Labour

Skilled workers	4
Semiskilled workers	2

Land and building

Nominal space requirement only in an existing work-shop.

Capital outlay

Assuming nominal expenditure will be required for machinery. The capital outlay is estimated to be as follows.

	Birr
Machinery and equipment	100,000
Building	-
Working capital	50,000
	150,000

Remarks

1. Due to the indefinite but relatively small volumes anticipated, this project would logically be associated with a foundry or other metal-working operation.

3819: SOLAR WATER HEATER

Product and Uses

The solar water heater has been developed to save fuel and electricity.

There are two types of solar collectors available:

- Solar air collectors
- Solar water collectors

Solar air collectors are intended for heating buildings and are built-in to the building in which they are installed. Given that Ethiopia's highland climate is cool but not frigid, little demand is foreseen for this application.

Solar water collectors are more useful and easier to install. They can be added to existing or new building (or installed near-by) for heating of household water and swimming pools. This is therefore the more interesting product. The solar water heater is suitable for meeting the hot water requirements of residential and commercial establishments, schools, colleges, office canteens, rural clinics, dairies and camps especially at higher altitudes.

The simplest solar collectors basically consist of flat plate collectors and a thermosyphon heating system.

The salient features of this solar water heater are:

Max. temp. attained	:	50° - 55°C (summer) 45° - 50°C (winter)
Capacity	:	70 litres/day of 8 hours.
Floor area	:	95 cm x 250cm.
Collector orientation	:	due south or possibly directional
Anticipated life	:	10 - 12 years.

While the rainy season would reduce the effectiveness of solar collectors to a point where electric hot water heaters would still be required, they would continue to provide a pre-heating function during sunny periods.

Solar collectors can work in pressurized or unpressurized (hand pumped) systems.

Excluding 1985, the average annual usage is approximately 200,000 rolls per year giving imputed total imports of 400,000 rolls.

No figures are available at this time on the import of paper tape although the more limited usage, basically for packaging, indicate a lower requirement.

Capacity

500,000 rolls per year in a single shift.

Process Description

Adhesive tape is made by coating adhesive on various material webs such as cellophane or plastic films, drying of solvent in the adhesive, winding on paper board rolls with a certain length and cutting into pieces in a certain width.

The manufacturing process for adhesive tape consists of three sections: adhesive preparation section, coating, drying and winding section, and cutting and packaging section.

- Adhesive Preparation

  Adhesives are prepared by mixing and dissolving rubber, resins and additives in solvent in a dissolving machine and storing in a tank for feeding to a coating machine.

- Coating, drying and winding

  The wide roll of cellophane film wound on paper tube is unwound and sent to a coating machine where adhesive is coated on the film. The coated film is then dried in an oven where solvent is evaporated by hot air. The dried coated film is wound on rolls.

- Cutting and Packaging

  The wide rolls are cut into the finished rolls of the desired width on a cutting machine.

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Raw-materials

Cellophane in a roll (36" width)
Adhesives
Rubber compound
Resins

Machinery and Equipment

a) Dissolving machine
b) Mixing roll
c) Sheet cutter
d) Storage tank
e) Coating machine
f) Tape cutter
g) Cone remover
h) Miscellaneous accessories

Personnel

2 - 3 Administration
5 - 6 Skilled worker
4 - 6 Semiskilled worker
10 -12 Unskilled worker

Land and Building

Land - 600 sq.m.
Building - 300 sq.m.

Capital Outlay

Machinery and equipment	Birr	250,000
Building	"	150,000
Working capital	"	100,000
		500,000

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PAPER TAPE

Product and Uses

There are many kinds of adhesive tapes viz, cloth tape, kraft-paper tape, cellophane tape, paper tape, plastic tape. These adhesive tapes have been widely used in such various fields as packaging, pharmaceutical and other industrial use. Glued paper tapes have various usages in industry and in stationery. At present the local demand of glued paper tape does not appear sufficient to establish a separate plant. Since the manufacturing process for cellophane tape and glued paper tape is quite similar, producing both the products in one plant is recommended.

Process

Glue solution is prepared in a tank for feeding to a coating machine.

The kraft paper wound on a tube is unwound and passed through a coating machine where glue solution is coated on the paper. The coated paper is then passed through a dryer where the glue is dried. The dried coated paper is wound on the roll. The wide rolls are cut into pieces to the required width.

Raw-materials

Kraft paper rolls 30" width
Standard glue
Paper cores

Personnel

2 skilled and 2 unskilled workers in addition to the requirement of cellophane tape making.

Machinery and Equipment

One additional tank for gum preparation

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Land and Building

No additional requirement

Capital Outlay

Additional requirement - Birr 50,000 for gum preparation tank and miscellaneous equipment.

Remarks

Since cellophane adhesive tapes and glued paper tapes are made by a similar method requiring almost identical machinery and equipment, it is strongly suggested that both the products should be considered for production in one unit.

3819: TELEVISION ANTENNA

Product and Uses

The television antenna is a special device used for receiving the signals from the transmitter which are then fed to the input stage of the television receiver. Although many televisions have built in " rabbit ear " antenna, which are usually adequate in locations close to the transmitter, external antenna improve reception in fringe areas. Generally these out door antenna are fixed at a roof height directing towards the T.V. transmitter. The height of the antenna would depend upon the distance of the T.V. receiver from the transmitter.

Where there are one or few stations as in Ethiopia antenna can be of a very simple fixed design perhaps in several sizes. T.V. Antenna consists of mainly three elements - a director, a dipole and a reflector. The director is always fixed towards the transmitting station. The dipole terminals are connected with a wire leading to the input of the T.V. set.

Market Potential

While there are estimated to be a relatively small number of T.V. sets in the country at presentlonly some 65,000 - 100,000) the spread of literacy is expected to have a spin-off effect in all information services such as TV. More over the spread of electricity means that TV sets will be able to operate in more areas also. Start-up of a local TV assembly plant would also have a positive effect.

While no demand growth figures are presently available, these factors do indicate that the demand for antenna will grow fairly rapidly-especially if their effectiveness can be demonstrated.

The capacity of 3000 antenna sets appears to be a suitable sales target, there being little or no production in the country at present.

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Capacity

Since the required equipment is fairly basic, the minimum capacity can be quite low and is set at 3000 sets per annum.

Process Description

The process is quite simple consisting of pipe cutting, bending and assembly. It may be desirable to have different sizes.

Anodised aluminium tubes are cut to size for the reflector and director. Tubes are bent in the form of a loop to make the dipole. Plastic terminal box (moulded) is made in the injection moulding machine. All these three parts are clamped together to a square or round bar at a pre-determind distance. The assembled antenna is fixed on a steel pipe at the time of fixing to the house. It may be more economical to subcontract the plastic terminal box manufacture.

Raw-materials

- Anodised aluminium tubes $\frac{1}{2}$ inch dia.
- Aluminium pipe $\frac{3}{4}$ inch dia.
- Aluminium square bar of size 1" x 1"
- Aluminium clamps and fittings
- Plastic powder for moulding
- Miscellaneous hardwares
- Galvanized steel pipe for mast
- Antenna cable (2 wire) (imported)

Machinery and Equipment

1. Pipe bending machine
2. Shearing machine
3. Drill machine
4. Power press
5. Injection moulding machine with moulds
6. Pipe drawing machine
7. Testing equipment.

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Personnel

Administrative	-	2
Skilled worker	-	2
Semiskilled worker	-	3
Unskilled worker	-	2

Land and Buildings

Land	-	350 sq.m.
Buildings	-	250 sq.m.

Capital Outlay

Machinery and equipment	Birr	125,000
Buildings	"	100,000
Working capital	"	75,000
		300,000

R e m a r k s

1. Capital and skilled labour requirements for this plant are moderate.

2. Better determination of demand and finalization of an appropriate design should be co-ordinated closely with the television authorities.

3833: ELECTRIC COFFEE MAKER FOR RESTAURANT USE

Product and Uses

The electric coffee maker is seen in virtually all coffee shops in Ethiopia to make the espresso and other types of coffee favoured by Ethiopians. Several sizes are used depending on capacity required.

The coffee-maker generates boiling water which is forced through the coffee grounds and also produces steam used to heat milk and water. The unit is essentially a tank where steam is generated by electrical submersion or gas heaters and includes level indicators, steam valves, pressure gauge and pressure safety valve. Water softeners may also be incorporated but this profile assumes that they would be imported as an optional extra and not manufactured here.

All requirements are presently imported. These are quite fancy and it appears feasible to consider making a somewhat simpler model which could be sold at a competitive price.

Market Potential

Instead of more general official trade statistics, the actual imports by Ethiopian Household & Office Furniture Enterprise are attached for the years 1982-84. Excluding the possibility of other imports by other firms, this indicates a regular potential for at least 110-150 units per annum.

ETHIOPIAN HOU[redacted]-HOLD & OFFICE FURNITURE ENTER[redacted]RISE

IMPORTS OF COFFEE MACHINES

Imported Year	D E S C R I P T I O N	Qnty	Unit Cost in Birr	Total Cost in Birr
1981	Faema Coffee Machine W/3 handle	1	5,041.96	5,041.96
1982	La Cimbali Coffee Machine L/1	12	2,306.10	27,673.20
	" " " " L/2	31	3,009.51	93,294.81
	" " " " L/2 with softener	12	4,184.34	50,212 08
	" " " " L/3 with softener	6	4,844.06	29,064.36
	" " " " L/3 type V.380 + gas	24	3,702.09	88,850.16
	Faema Coffee Machine C/2 with softener & volometeric pump	24	4,557.50	109,380.00
	Total	109	-	398,474.61
1983	La Cimbali-Espresso Coffee machine L/1 V380+gas with all accessories	12	2,248.71	26,984.52
	" " " " " L/2 " " " "	48	2,933.10	140,788.80
	" " " " " L/3 " " " "	24	3,607.71	86,585.04
	Item as above C/2 with softener L/5	12	4,077.01	48,924.12
	" " C/3 " " "	12	4,722.29	56,667.48
	Faema Coffee Machine No stop (EX p/4) 2 group with accessories	36	5,129.24	184,652.64
	Total	144	-	544,602.60
1984	La Cimbali Coffee Machine type L/1 V380+gas	12	2,223.00	26,676.00
	" " " " " L/2 " "	60	2,899.00	173,940.00
	" " Espresso Coffee Machine L/3 V380+gas	24	3,575.00	85,800.000
	" " " " " C/2 V380+gas with softener L/5	12	4,108.00	49,296.00
	" " " " " C/3 V380+gas " " "	12	4,758.00	57,096.00
	Total	120	-	392,808.00
	Grand Total	-	-	1,340,927.17

Capacity

200 machines per annum on one shift

Process Description

The process is mainly one of sheet metal work.

Cut and form sheet metal for tank, base, covers
Cut and form piping
Turn handle/coffee container and other special parts on lathe
Braze/weld parts
Electroplating (by others)
Assemble tank and pressure test
Complete assembly
Pack for shipment

Raw-materials

The sheet metal parts can be of various materials although brass for the tanks is the easiest to work.

Brass sheet - 14 ga.
Side/top panels - aluminum, electroplated brass and or plastic sheet
Frame angles - aluminum/brass
Heating elements (3kw) and associated switches, plugs, fuses and wiring.
Rotary steam valves (5)
Pressure gauge
Water level indicator assembly - glass-tube (2-3)
Pressure safety valve
Brass piping, nipples, plug
Gaskets
Brazing material and gas

Machinery and Equipment

Shearing machine
Rolling machine

.../

Press
Lathe
Drill press
Gas welding set
Pressure and electrical testing equipment
Dies and hand tools

Personnel

Administration	3
Direct labour	
Skilled	3
Unskilled	3

Land & Building

Land	400 m^2
Building	200 m^2

Capital Outlay

Machinery & equipment	Birr	200,000
Building	"	100,000
Working capital	"	75,000
		375,000

Remarks

1. Although the raw-materials would continue to be imported, the high price of the imported units indicates potential for significant foreign exchange savings.

2. A certain amount of design work will be required to develop a machine which performs equivalent to imported models but which is of simpler design and thus fabricated more economically.

3839: FLASHLIGHT

Product and Uses

The flashlight (torch light) is a portable light powered by a dry cell battery with an on-off switch. The bulb and dry cells are usually replaceable. While flashlights may be made of plastic, this profile considers manufacture of a metal design as being the most suitable for small-scale production.

Flashlights find use in all areas, with regular use in areas where electricity is not available in the home or on the street as well as for emergency use by other users.

Market Potential

Although all flashlights are imported, a review of trade statistics did not enable the number of flashlights actually imported to be determined.

Estimation of demand is therefore based on an imputed utilization of flashlights by the population. Current population is about 42 million and the 1980 statistical abstract shows 4.3 persons per household. If 20% of all households own a flashlight, a flashlight lasts 8 years and the population is growing by 3% per annum then the current approximate demand for flashlights is computed as follows:

New demand: $\frac{42,000,000}{4.3} \times .03 \times 0.2 = 58,505$

Replacement: $\frac{33,000,000}{4.3} \times 0.2 \times \frac{1}{8} = \frac{191,860}{250,465}$

Although the necessity for flashlights will decline somewhat with electrification, they will still be kept for emergency use. Any decline is expected to be offset by the population growth.

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This analysis should be confirmed with a user and importer survey especially as to the likely percentage of households owning a flashlight.

Capacity

Production capacity is estimated conservatively at 150,000 flashlights per year on the basis of single shift working, allowing for some continuing import. Greater demand could be met by two shift operation.

Process Description

Basically flashlights are made out of sheet metal components processed in forming, rolling and pressed machines by using suitable tools. Since there are a good number of small components in a flashlight, use of scrap as a portion of raw material may be quite economical. Sheets or scrap are first sheared to size. Then they are given shape in rolling machine/forming machine or a press using the proper die for the purpose. The body of the flash light is knurled and electroplated. Then the components are assembled together and finished. Use of simple gauges are necessary to check the various parts at each stage of manufacture.

Raw-materials

Tin coated M.S. sheet 26 SWG to 28 SWG
Copper wire
Glass
Plastic sheet for knob
M.S. and spring wire
Miniature bulbs
Electroplating materials (may be subcontracted)

Machinery and Equipment

1) Power press 30 ton capacity
2) Bail press

..../

3) Rolling machine
4) Shearing machine
5) Wire straightening and cutting machine
6) Drill press
7) Wire rolling machine (to make spring)
8) Double end grinding machine
9) Lathe machine
10) Different sets of dies, jigs, fixtures and gauges
11) Miscellaneous hand tools
12) Soldering equipment
13) Small electroplating facilities (optional)

Personnel

Administrative	- 2
Skilled workers	- 3
Semiskilled workers	- 4
Unskilled workers	- 3

Land and Building

Land	- 350 sq.m.
Building	- 200 sq.m.

Capital Outlay

Machinery and equipment	Birr	300,000
Building	"	100,000
Working capital	"	250,000
		650,000

3813: AUTOMOTIVE HYDRAULIC TUBING AND HOSES

Product and Uses

Hydraulic tubing fabricated from steel is used on fuel and brake systems for virtually all vehicles. In tractors it is also used in the hydraulic system used to raise and lower implements. The product is composed of tubing bent to shape with threaded connectors installed.

An associated product is hydraulic hoses which have threaded connectors.

Market Potential

Potential exists to manufacture for trucks and buses produced at AMCE as well as eventually for the tractor factory at Nazret. There is also a known replacement market at AETSC as spares for tractors and combine-harvesters as well as the general market for all other vehicles in Ethiopia including construction and farm equipment. The extent of the latter requirement is presently unknown and requires analysis.

In the case of AMCE, it has been found that present capacity is approximately 800 vehicles per year with plans to build up to 3000 per year over ten years. Although not yet confirmed, these are estimated to be about 20 tube sets per vehicle giving approximate demand of 16000 units at current capacity.

Requirements for AETSC were evaluated taking the East German tractor model 300/303 and combine harvester model E-512 as an example, since these are in largest use. It was found that there are some 48 different types of piping used with a total 1983/84 usage of 4400 pipe assemblies having an aggregate cost of Birr 59,000. In addition AETSC also sells and services a Yugoslav tractor and combine harvester although time did not permit an analysis of requirements.

..../

Given that a total of 791 GDR units and 571 Yugoslav units have been sold by AETSC, an imputed usage of 3200 pipe assemblies worth some Birr 43,000 is estimated for the Yugoslav units.

There would also be a demand for maintenance requirements of cars and trucks but given the variety of models this may not be feasible to address except in a few instances.

Although at present tractors are completely imported for assembly at Nazret, there are plans to commence manufacturing of parts domestically. Output is presently at the rate of 500 units per year with plans to increase this to 3000 per year. It is estimated that some 40 - 50 separate tubing assemblies are required per tractor, giving a requirement at present output levels of 20 - 25000 sets.

Market demand has not yet been researched for hydraulic hoses but would consist basically of construction and farm equipment. At present, for instance AETSC buys finished hoses for spare parts which means that a significant inventory must be carried.

Capacity

The operation would be designed to manufacture 50,000 tube assemblies plus an unspecified number of hydraulic hose assembles per year on a one shift basis having a value for tubing of approximately Birr 600,000 based on AETSC costs.

Process Description

While the full process may ultimately include tube drawing from sheet in Ethiopia, especially if it could be combined with that for radiator manufacture, it is probable that the initial process will exclude this step due to limited volumes.

The steps would therefore be as follows:

Machine connectors
Install connectors and swage tube ends

/

Bend to shape
Test

Raw-materials

Brass/steel stock of hexagon or other shape
Steel tubing
Hydraulic hose

Machinery and Equipment

Power hacksaw
Center lathe
Swaging machine
Bending jigs & fixtures
Tap and die set
Hydraulic hose fitting machine
Pressure testing equipment
Sample tube sets

Personnel

Administration - Staff from existing organization
Supervisor - 1
Direct labour - 6

Land and Building

Land - 300 m^2
Building - 200 m^2

Capital Outlay

Machinery and equipment	Birr	100,000
Building	"	100,000
Working capital	"	200,000
		400,000

..../

Remarks

1. As a very small scale endeavour, it appears preferable to include this process with another metal working operation to save on overhead costs.

2. Given the large number of various tube assemblies a high degree of flexibility of operation is essential. Sample tube assemblies would be procured from original equipment suppliers to allow set-up to be done more easily and to ensure conformity with requirements.

3843: AUTOMOTIVE RADIATOR AND OIL COOLER MANUFACTURE

Product and Uses

Radiators and oil coolers essentially consist of tubing surrounded by fins for efficient cooling of liquids mainly in automotive equipment. Materials used are copper, brass, zinc, tin and lead as well as sheet steel for housings.

Radiators are expensive, up to Birr 3000 each for trucks, as well as being particularly susceptible to damage during transport.

The facility would also manufacture radiator caps and thus could also make replacement caps for radiators, oil fillers and fuel tanks.

Market Potential

Base demand for a radiator manufacturing facility would be the five or so models used in bus and truck manufacturing at AMCE with a present capacity of 800 vehicles per year with a ten year plan to increase this to 3000 vehicles. Replacement radiators and oil coolers are also required for tractors and combine harvesters sold by AETSC. The main usage is for East German equipment which in 1984 amounted to 58 radiators of part 4084600108 at an AETSC unit selling price of Birr 1069 plus an estimated 40 radiators for Yugoslav units (based on relative quantities of units).

There is also potential for modest sales to Ethio Bus Assembly of Asmara, presently amounting to some 25 units annually in various models.

The plant would also cater eventually to the requirements of the Nazret tractor factory currently operating at an output of 500/per year with plans to increase to 3000 per year. This latter will however require a change in method from the present system of importing complete tractor kits.

...../

There is also potential for major rebuilding and supply of radiators for the general automobile replacement market. The Spare Parts Importing and Distribution Enterprise (SPIDE) was contacted in this regard since they handle spare parts for the National Freight Transport Corp. (1000 trucks) and National Bus Transport Corp. (300 buses) as well as truck/bus requirements for other government organizations. It was indicated that their needs are for 100-150 radiators per year in 10-15 types. There are also other private importers for trucks and car parts.

The actual and potential 'demand' in this sector requires further study but given the multiplicity of models in the replacement market it may not be economically feasible to aim for a major share of this sector, except possibly in a rebuilding function.

Capacity

One thousand five hundred units per year appears to be a reasonable initial capacity for nominal one shift operation with increased requirements met by another shift and eventually facility expansion.

Process

Initial production would be made from imported brass tubing and thin alloy sheeting since automatic tube drawing machines are expensive. As experience is gained and depending on economics, a tube drawing machine could be purchased to allow importation of sheet only. Alloy ingots could eventually be rolled locally once a sheet rolling mill is constructed. It may also be possible to combine the tube drawing process with that of the hydraulic piping project (3843).

Process steps are:

- Draw brass tubing from sheet (eventually)
- Tin brass tubing
- Punch and emboss fins from copper sheet
- Assemble tubes and fins in assembly jigs

.../

- Flux cores
- Bake and square cores
- Pressure test cores
- Press header plates
- Dip solder header plate and assemble with cores and other attachments
- Pressure test assembled radiator block
- Cut and press housings
- Paint
- Manufacture radiator cap.
- Final assembly

Raw-materials

Brass tubing
Non-ferrous sheets
Galvanized sheet steel
Brass drain cocks
Solder

Brass and other alloy ingots would eventually replace brass tubing and alloy sheets depending on the economics for sheet rolling and tube drawing. (Exact amounts will depend on the requirements of the particular models to be made)

Machinery and Equipment

Automatic tube drawing machine (eventually)
Automatic strip tinner
Automatic fin roller
Presses
Core assembly jigs
Soldering oven
Solder dipping, fluxing and draining equipment
Shearing and bending machines
Drilling equipment
Spot welding set
Compressor

...../

Dies, tools, fixtures
Radiator cap, punching, forming and assembly presses
Painting shop equipment

Labour Requirements

Administration/engineering	7
Direct labour - skilled	5
- semi & unskilled	5

Land and Buildings

Land	900 m^2
Buildings	300 m^2

Investment costs

Machinery and equipment	
- tube drawing equipment	Birr 100,000
- other	" 400,000
Buildings	" 150,000
Working capital	" 500,000

Remarks

This project would significantly increase local content of the AMCL vehicles as well as eventually the Nazret tractors in line with government wishes. There would also be significant, although immeasurable, economic benefits and foreign exchange savings in other sectors of the automotive replacement market.

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Product and Uses

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- Bake and square cores
- Pressure test cores
- Press header plates
- Hot solder header plate and assemble with cores and other attachments
- Pressure test assembled radiator block
- Cut and press housings
- Paint
- Manufacture radiator cap.
- Final assembly

Raw-materials

Brass tubing
Non-ferrous sheets
Galvanized sheet steel
Brass drain cocks
Solder

Brass and other alloy ingots would eventually replace brass tubing and alloy sheets depending on the economics for sheet rolling and tube drawing. (Exact amounts will depend on the requirements of the particular models to be made)

Machinery and Equipment

Automatic tube drawing machine (eventually)
Automatic strip tinner
Automatic fin roller
Presses
Core assembly jigs
Soldering oven
Solder dipping, fluxing and draining equipment
Shearing and bending machines
Drilling equipment
Spot welding set
Compressor

...../

Dies, tools, fixtures
Radiator cap, punching, forming and assembly presses
Painting shop equipment

Labour Requirements

Administration/engineering	7
Direct labour - skilled	5
- semi & unskilled	5

Land and Buildings

Land	900 m^2
Buildings	300 m^2

Investment costs

Machinery and equipment		
- tube drawing equipment	Birr	100,000
- other	"	400,000
Buildings	"	150,000
Working capital	"	500,000

Remarks

This project would significantly increase local content of the AMCL vehicles as well as eventually the Nazret tractors in line with government wishes. There would also be significant, although immeasurable, economic benefits and foreign exchange savings in other sectors of the automotive replacement market.

[illegible]:

[illegible] B. [illegible]

Product profile

[illegible] for bicycles will be bicycle [illegible] manufacturers.

[illegible] will be used mainly for load-carrying utility bicycles while kick-stands would support the bicycle when stationary.

Market Potential

[illegible] is unknown due to lack of import information to the extent required but is probably small given the low level of import levels imports. When production starts in the country however the demand for such items will be more substantial.

[illegible] small-scale bicycle production it is estimated that 3000 carrier, kick-stands and other items could be sold. Given the south [illegible] road conditions, virtually all bicycles would require fenders (mud-guards) thus giving a demand of 3000 per annum for small-scale bicycle manufacture plus the output (presently unknown) of the planned public corporation.

Capacity

Carriers and kick-stands could be manufactured on a limited scale if done by a [illegible]-working shop working either stamped items on the same equipment. This would be essential initially since the relatively high cost of equipment could not be justified for the small volumes to be made at least until a public sector bicycle manufacturing company is in operation.

..../

[illegible]

Tools required:

a) [illegible], knife, [illegible]

- Cutting
- Drilling
- Filing
- [illegible]
- [illegible]
- Stripping

b) Pliers

Although fuse wire is normally supplied with a protective plastic, it is necessary to remove a small length of this plastic before fitting the fuse wire strip.

The process is as follows:

- Cut strip on a wire machine
- Mill [illegible]
- [illegible]
- Punch holes
- Cut, file, [illegible] the wire strip
- Drill fittings
- [illegible] point
- Assemble

Raw materials

a) [illegible] and kick-stands

- Steel strip, 1 mol
- Spring
- Nuts, bolts
- Metal point

..../

- 4 -

a) [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

__Machinery and Equipment__

a) Carriers and kick-stands

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] pickling tanks

[illegible]

[illegible]

Hand tools, jigs etc.

b) Fenders manufacturing would require the following additional equipment.

Fender rolling machine with full set of rolls

__Personnel__

Administration - existing staff

	a) Carriers, kickstands & chain-guards	b) Fenders	Total
Skilled worker	1	2	3
Semi/unskilled	1	4	5

__Land & building__

Land 500 m^2

Building 100 - 200 m^2

..../

Capital outlay

Machinery & equipment

- carriers, kickstands, chain-guards	[illegible]
- additional for fenders	[illegible]
	[illegible]
Building	[illegible]
Working capital	
- carriers and kickstands	[illegible]
- fenders	2,000
	[illegible]

Remarks

1) This item was considered truly viable for a separate facility only when a large scale public sector bicycle manufacturing facility is established. However carriers, kickstands and chain-guards could be made in an existing sheet-metal working facility to cater for local needs of small-scale bicycle manufacturing facility is in operation.

Sub-: BICYCLE MANUFACTURING

Product and uses

"The bicycle is the most common wheeled vehicle in the world with a large market in both developed and developing countries. In developing countries it is essentially a utility vehicle, widely used in both urban and rural areas for personal transport and for the movement of goods. The demand is predominantly for the traditional heavy duty roadster model, usually fitted with rod brakes. Bicycle manufacture can be efficient over a wide range of outputs, and there is scope for gradual industrialization through frame manufacturing followed by component manufacturing as demand rises. Cycle repair and maintenance operations also offer an important avenue for the encouragement of skills relevant to rural industrialization." [1)]

Establishment of a bicycle manufacturing facility would encourage the growth of ancillary industries such as tire/tube manufacture, kick stands, carriers, chain-guards, fenders and eventually more capital intensive parts such as rims.

It is envisaged that production would consist initially of a utility model as well as a multi-speed model in various adult sizes.

Market Potential

The Ethiopian market is entirely supplied by imports. Latest available statistics indicate that recorded imports have been minimal probably due in part to foreign exchange constraints.

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1) Optimum Scale Production in Developing Countries: A preliminary Review of Prospects and Potentialities in Industrial Sectors. UNIDO/IS.471 June 1984.

Based on import statistics for tires and tubes it is estimated that there are some 4[illegible],000 active bicycles in the country, which is low in relation to population.

Imports of Bicycles (735.21)

	No.	Value (Birr)
1982	572	135,882
1981	715	158,433
1980	99	21,403
1979	1,165	99,350
1978	5,323	346,060
1977	17,527*	380,813
1976	4,241	396,764

Any thorough evaluation of demand for bicycles would have to consider trends and economics of competitive transport means. These range from donkeys mainly in the countryside, although still common in Addis Ababa, horse and cart "taxis" in regional towns and taxis, buses and private cars in Addis Ababa. The main indication of potential change in market potential is the recent proclamation encouraging bicycle use due to the desire to conserve petrol. Given also the increasing cost and difficulty in maintaining automobiles due to foreign exchange problems, the most attractive market would appear to be for a lighter weight town, possibly multi-speed, model. It is also suspected that there is an increasing cost and difficulty in looking after draft animals which if true could also give an impetus to demand for utility models, mainly for load carrying.

There are studies underway for a public sector company manufacturing bicycles but the large population of potential users should allow two manufacturers to coexist given that the small-scale output would be expected to be relatively limited.

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* Inconsistent.

There may also be potential for sales of the Extrike load-carrying tricycle developed by the Intermediate Technology Group of U.K. perhaps in part as competition for the horse and cart "taxi" but the lack of any history in this area means that market trials of a prototype would be required before making a manufacturing decision.

Capacity

The factory would be sized to allow production of approximately 5000 bicycles on one shift. The layout would be planned however to allow for future expansion.

Process Description

Given relatively low volumes projected, the manufacturing operation would essentially be confined to manufacture of the frame and installation of mainly purchased components.

Cutting, forming and bending of steel tubing and sheet
Joining of frame components and forks by welding in jigs
Painting
Baking
Strength testing
Assembly of wheels
Bicycle Assembly

Traditionally bicycle frames have been built using lugs at brazed joints, which at projected volumes mean that the large and complex bottom bracket (which houses the pedal-axle) would likely be imported. A recent development however has been a lugless design using MIG welding techniques and suitable jigs and fixtures allowing semi-skilled labour to produce high quality frames efficiently. This design would eliminate import of lugs and allow the bottom bracket to be made from a simple threaded tube.

.../

Raw materials

At anticipated volumes and pending large scale manufacture in Ethiopia, nearly all components would be imported. This is normal international practice even in countries such as Canada.

Bicycle frame tubing (imported)
Tubing for bottom bracket
Flat strip and sheet steel
Components (all imported initially)
Enamel paints, primers, transfer labels
Lugs and bottom bracket (if MIG welding not feasible)

Machinery and equipment

Power presses (2) and dies
Tube threading machine
Shearing machine
Drilling machine
MIG welding set and related equipment*
Frame and fork assembly jigs (4)
Phosphetizing and rinse tanks
Painting booth with dipping tanks
Baking oven
Load testing jig
Grinder

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* If MIG welding process proves not to be feasible then a brazing furnace and oxy-acetylene gas welding set would be required instead.

Personnel

Administrative/sales manager	1
Clerk/accountant	1
Technician	1
Quality control inspector	1
Foreman	2
Skilled workers	6
Semi and unskilled	15
Clerical, guards, helpers	6
	33

Land & Building

Land	1200 m²
Buildings	500 m²

Capital Outlay

Machinery and equipment	250,000
Building	300,000
Working capital	400,000
	950,000

Remarks

1. A bicycle assembly project would have a catalyst for growth of related products such as tubes, tires, carriers, kick stands, mud-guards, pumps and chain. By substituting for car travel there would also be a significant foreign exchange saving for petrol and expensive spare parts.

2. Training especially in forming and welding for two people would be required at a commercially viable facility.

3909: CELLOPHANE TAPE AND PAPER TAPE

Product and Uses

Cellophane tape (cellophane adhesive tape) has adhesion in a normal state which maintains its adhesive property when attached with only light finger pressure.

Cellophane adhesive tapes are widely used in such various fields as packaging, in business offices, educational institutions, pharmaceutical and other industrial uses.

Glued paper tape used mainly in the packaging industry has a similar manufacturing process technology to that of cellophane tape and could therefore be produced in the same plant. A separate information sheet on additional plant requirements for paper tape manufacture is attached to this profile.

Market Potential

Given the lack of sufficiently detailed information in the import statistics, discussions were held with ETIMEX who estimate that they import approximately 50% of the country's usage of various types of tape.

Statistics are only available on cellophane tape as follows:

IMPORTS OF CELLOPHANE TAPE BY ETIME

	No. of Rolls	Value C&F (Birr)	Value Landed cost (Birr)
1982	234,800	122,839	228,354
1983	50,000	6,400	12,060
1984	330,000	76,769	139,191*
1985 to date	-	-	-

*Estimate

Source: ETIMEX

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Market Potential

Fuel economy is one of the major areas where developing nations such as Ethiopia have to concentrate to conserve much needed foreign exchange. Because of Ethiopia's cool climate, hot water can be extensively used in the residential and commercial establishments in the urban as well as rural areas. Particularly in the rural areas where procuring of fuel and electric energy is difficult, solar heaters using abundantly available solar energy can be made to supplement.

As an item not used extensively in Ethiopia, demand is difficult to quantify. Since the unit is fairly easily fitted to existing houses as well as to new construction, potential demand could be very high especially in the cool highland areas where most of Ethiopia's population lives. The actual demand would depend on how economical the capital cost (including installation) is compared to the electricity cost for hot water heating. A 2-3 year payback would probably be required to convince people to make the investment and introduction would also require a related campaign effort to publicize this saving. A further complication in urban areas is the public ownership of many houses which would require that the government install the units since tenants would not be willing to make the investment unless portable units proved feasible.

Capacity

Since the manufacturing process is labour intensive a small unit producing 3000 sq.m. of solar panel i.e. 1000 units a year can be envisaged as the minimum size economical unit.

Process

Manufacturing simple solar collectors is not difficult since it is basically a sheet metal cutting and bending and assembly operation.

..../

Raw-materials

The raw-materials required for construction of solar water heaters are M.S. and G.I. sheets/plates, G.I. pipes, glass sheets, aluminium sheets, etc.

The main raw-material components are:

- Glazing (which gives a greenhouse effect)
- Dished plates (absorbant surface) covered in black material
- Metal plates in iron/copper (heat-carrying fluid network)
- Polyurethane plates (insulators)

Most raw materials are imported. These specialty items may have to be imported through a licensor (i.e from France, Japan..) Sheet glass and other standard items could however be purchased locally.

Machinery and Equipment

Main componentsof machinery and equipment consists of:

a) Milling machine
b) Bench drilling machine
c) Double ended bench grinder
d) Centre lathe
e) Shearing machine
f) Pipe bending machine
g) Air compresser
h) Baking oven
i) Painting booth
j) Spray gun
k) Set of hand tools

Personnel

8 - 12 people including
3 skilled assemblers

Land and Building Requirement

Land - 600 sq.m.
Building - 400 sq.m.

Capital Outlay

Machinery and equipment	Birr	180,000
Building	"	180,000
Working capital is estimated at	"	**140,000**
		500,000

Remarks

1. The project idea is very attractive in principle, as it would enable energy saving and could find applications in rural areas where electricity is not available or in short supply.

2. Since it is of a pioneering nature, and in view of the economic benefits to the country, it will be worthwhile for the government to assist in development of appropriately designed units as well as to publicize the benefits of such a product.

3. Since this product is amenable to small scale production if introduced successfully, many new manufacturers could easily enter the field with questionable products. A government quality licensing scheme should therefore be considered to ensure acceptability.

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b) Bench drilling machine
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d) Centre lathe
e) Shearing machine
f) Pipe bending machine
g) Air compresser
h) Baking oven
i) Painting booth
j) Spray gun
k) Set of hand tools

Personnel

8 - 12 people including
3 skilled assemblers

Land and Building Requirement

Land - 600 sq.m.
Building - 400 sq.m.

Capital Outlay

Machinery and equipment	Birr	180,000
Building	"	180,000
Working capital is estimated at	"	140,000
		500,000

R e m a r k s

1. The project idea is very attractive in principle, as it would enable energy saving and could find applications in rural areas where electricity is not available or in short supply.

2. Since it is of a pioneering nature, and in view of the economic benefits to the country, it will be worthwhile for the government to assist in development of appropriately designed units as well as to publicize the benefits of such a product.

3. Since this product is amenable to small scale production if introduced successfully, many new manufacturers could easily enter the field with questionable products. A government quality licensing scheme should therefore be considered to ensure acceptability.

[illegible] :- [illegible]

Product use

Duplicating stencil papers are used for the purpose of duplicating various types of documents. More than one thousand copies can be produced from each stencil.

Market potential

The main consumers of stencil papers are the different government and semi-government institutions, office establishments and educational institutions. Besides these, various private commercial establishments also use stencil papers to a great extent.

At present there is not a single unit in the country producing stencil papers, all requirements being met through importation. The table below shows the total import of duplicating stencil papers during the period 1977 to 1982. Import figures for 1983 and 1984 are not yet available.

Duplicating stencil papers
(1982-1977)

Year	Tons	Birr ('000's)
1982	103	716
1981	61	484
1980	107	853
1979	98	847
1978	285	607
1977	146	551

Source: Annual External Trade Statistics.

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According to the import statistics the average annual import is in the order of 1½ tons. It is expected that the demand for stencil paper will increase in the future due to the increase of commercial and industrial activities. However with a demand of 150 tons a year, an economical unit for producing stencil paper can be established.

Capacity

Production capacity per annum on single shift is 125 tons.

Process description

The pigments and oil are mixed and ground thoroughly on the triple roll mill to make paste. This paste is mixed in a high speed mixer, with nitro-cellulose, ether and spirit, titanium dioxide and other chemicals for an hour. Then paste is coated on tissue paper by a stencil tissue coating machine and after that it is wound on a receiving roller. The coated paper roll is then taken to the stencil collating machine, where paper, interleaving paper and backing paper, fed simultaneously, are pasted to the tissue paper, then printing and cutting is done. All the operations are automatic.

Raw materials

- Tissue paper,
- Nitro-cellulose,
- Alcohol,
- Backing paper,
- Interleaving paper,
- Carbon paper,
- Ether,
- Spirit,
- Titanium Dioxide,
- Castor oil,

.../

- Glue,
- Ink,
- Some other chemicals like butyl alcohol, butyl acetate, etc.
- Packing materials.

All the raw materials except part of paper and packing materials will have to be imported.

Machinery equipment

1) Triple roll mill,
2) High speed mixing machine,
3) Stencil tissue coating machine,
4) Power press,
5) Stencil collating machine,
6) Boiler,
7) Testing equipment.

Personnel

7 - Administration
6 - Skilled workers
3 - Semiskilled workers
6 - Unskilled workers.

Land and building

Land 500 sq. m.
Building 300 "

.../

Capital outlay

Machinery and equipment	Firm	350,000
Buildings	"	150,000
Working capital	"	150,000
		650,000

Remarks

The plant requires a moderate amount of capital and skilled labour. The plant is automatic but requires skilled supervision. Most of the raw materials are imported but there is high value added.

3909: INSULATING TAPE

Product and Uses

Insulating tape is generally used to wrap bare electrical conductors mainly at connections to prevent short circuits and consequent electric shock, fires and/or equipment failure. While there are different types of tape including rubber, plastic and cloth, the latter is suggested here due to availability of locally produced cloth. This tape has a coating of rubber solution to produce a water-resistant covering. Tape comes in various sizes, the most popular being 15mm, 20mm and 25mm width and 10-25m. long.

Insulating tape is used particularly in the following areas:

- automotive assembly and repair
- armature rewinding and other motor (generator) transformer repair
- telecommunications
- electronics
- household repairs
- electric building and distribution wiring (small use)

Market Potential

Little information has so far been found an usage of insulation tape, through analysis of trade statistics, contacts with Ethio Import and Export Corp. (ETIMEX) on imports, and analysis of usage by Ethio Electric Light and Power Authority (EELPA).

The only information obtained was from EELPA which showed little tape use with a total 1982/83 (E.C. 1974) purchase of 14600 rolls of different kinds of tape, and no purchases in 1983/84 (E.C.1975).

One of the important uses is in the automotive sector where with approximately 100,000 vehicles ir Ethiopia the

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imputed demand for tape is not felt to exceed 50,000 rolls per year and possibly much less.

It is therefore difficult to see usage exceeding 150,000 - 200,000 rolls per annum and even this should be subject to close analysis.

However with the spread of electricity distribution, telecommunication and the increasing number of vehicles, demand will continue to increase somewhat higher than the rate of population growth, anticipated around 5% per annum.

Capacity

200,000 rolls per annum

Process Description

The rubber compound with required chemical composition (oil, resin, carbon black, mineral rubber, asbestos etc.) is thoroughly mixed with solvent in a mixing machine and stored in a tank for feeding to a coating/spreading machine.

The rolled cotton fabric of 24" width is unrolled and passed through the coating/spreading machine where rubber compound adhesive is coated on one side of the fabric. The coated fabric is then dried in an oven where the solvent is evaporated. The dried coated fabric is wound into a cardboard roll.

The roll is then slit to produce the finished rolls of insulating tape.

Raw-materials

- Cotton fabric (long cloth)
- Rubber solution (resin, carbon black, mineral rubber etc.)
- Cardboard tube
- Packing materials including polyethylene film

Machinery and Equipment

a) Mixing mill
b) Coating machine/spreading machine
c) Cutting machine
d) Miscellaneous hand tools
e) Mixing drums/tanks with stirrer

Personnel

Administrative	- 2
Skilled worker	- 2
Semiskilled worker	- 3
Unskilled worker	- 4

Land and Building

Land	- 350 sq.m.
Building	- 250 sq.m.

Capital Outlay

Machinery and equipment	Birr	250,000
Building	"	100,000
Working capital	"	100,000
		450,000

R e m a r k s

1) At present demand does not appear to be high relative to the minimum economic size of operation and is not very well defined. It may therefore be worthwhile to consider this project as an adjunct to that for 3909: Cellophone & Paper Tape, since equipment requirements and technology are similar.

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[illegible] : [illegible]

[illegible]

Typewriter ribbons are made mainly from fine fabric of cotton or synthetic materials. They are usually in the styles, all black or black-red wound on spools for normal office typing. The spools may be of metal or plastic material.

All requirements are imported at present.

[illegible]

The imports of typewriter ribbons have been as follows:

[illegible] for Typewriters
([illegible])

	[illegible]		
	Quantity ([illegible])	No. of rolls*	Value (Birr)
1972	[illegible]	[illegible]	[illegible]26,[illegible]
1973	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]
1975	3,[illegible]71	13[illegible],9[illegible]3	2[illegible],[illegible]17
1976	12,33[illegible]	121,657	248,445
1977	11,[illegible]61	196,[illegible]	19[illegible],366
1978	[illegible]	[illegible]	145,629

[illegible] imports by [illegible] of typewriter ribbons are as follows:

	No. of rolls	Value C.I.F.(Birr)	Value Landed Cost(Birr)
1976	17[illegible],[illegible]	[illegible],75[illegible]	171,477
1977	[illegible]	[illegible]	[illegible]4,699
1978	[illegible]	[illegible]	[illegible]

* [illegible]
[illegible]

While imports have fluctuated, it is estimated that minimum demand would be about 150,000 rolls per year with 250,000 rolls per year not considered an unreasonable estimate of medium term requirements.

Capacity

Planned capacity would be 300,000 rolls on one shift.

Process Description

The process assumes purchase of the spools either made up or in component form, as well as required inks. The steps are therefore as follows:

- Slit cloth to required ribbon width
- Wind on rolls
- Ink ribbon
- Assemble spools - if bought as components
- Install eyelets and wind on spools
- Vacuum seal and box

Raw-materials

Fine cambric cloth (domestic if possible)
Inks
Eyelets
Spools
- Plastic discs (possibly from thioplastic)
- Sheet metal tube (stamped and rolled in a metal-working shop)

Packaging material - plastic film and pasteboard.

Machinery and equipment

Slitting machine
Inking machine

.../

Hydraulic press

Sealing machine

Vacuum sealing machine

Personnel

Manager	1
Supervision/technician	1
Skilled workers	2
Semi-/unskilled workers	2

Land & Building

Land	400 m^2
Building	200 m^2

Capital Outlay

	Birr
Equipment	150,000
Building	100,000
Working capital	50,000
	300,000

Remarks

1. This project is a relatively low cost one and could appeal to an entrepreneur as a project on its own or could be combined with a related product e.g. printing inks, office supplies manufacture.

2. It is likely that, initially at least, all inputs would be imported although it is hoped that cambric cloth and spool components could eventually be purchased domestically.