



**TOGETHER**  
*for a sustainable future*

## OCCASION

This publication has been made available to the public on the occasion of the 50<sup>th</sup> anniversary of the United Nations Industrial Development Organisation.



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

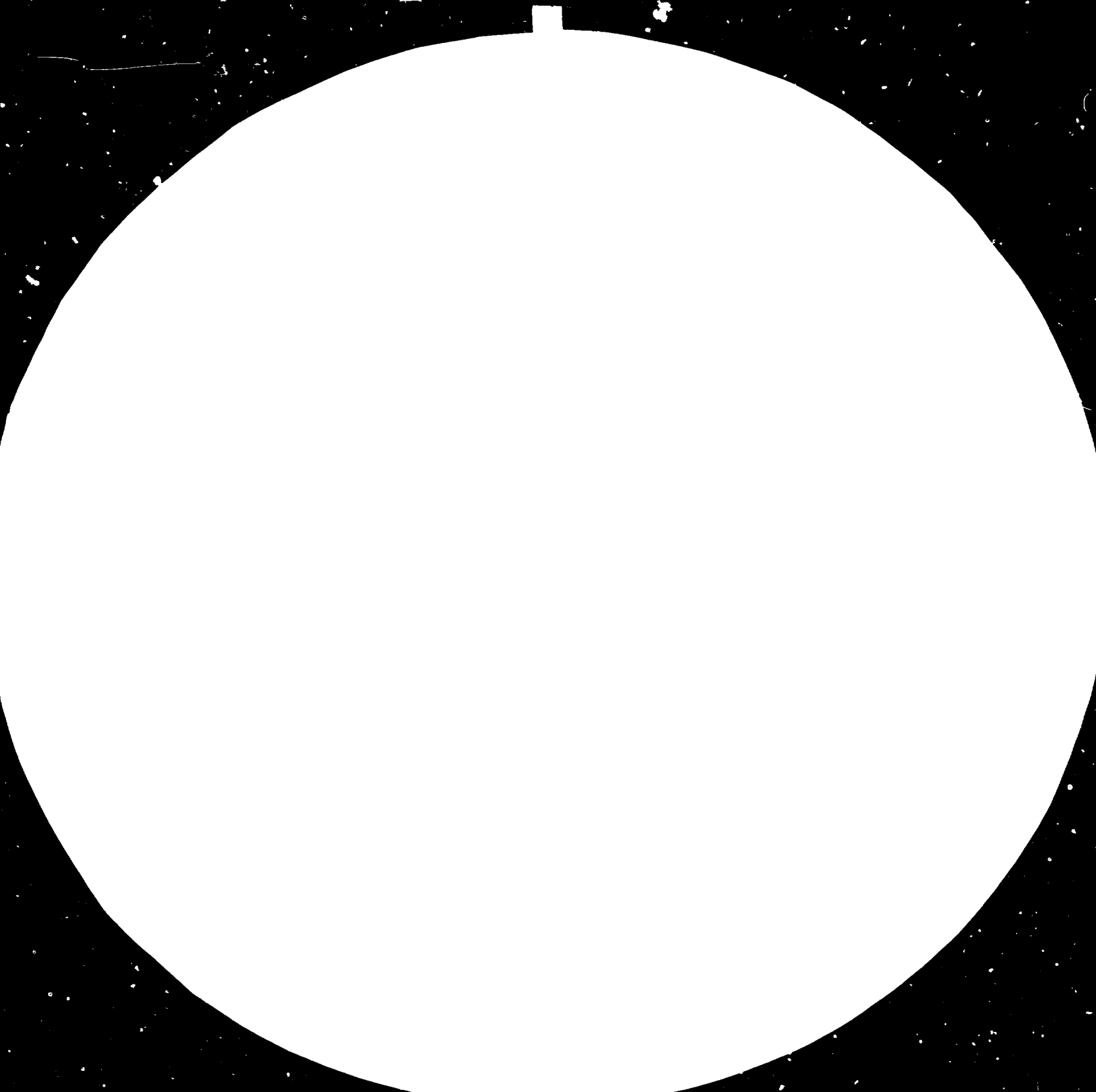
## FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)





28



32



36



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS  
STANDARD REFERENCE MATERIAL 1010  
APR 1963, 100X TEST CHART 1010



13264-E



Distr.  
LIMITED

ID/WG.411/3  
16 January 1984

ORIGINAL: ENGLISH

**United Nations Industrial Development Organization**

---

Third Consultation on the Leather and  
Leather Products Industry

Innsbruck, Austria, 16-20 April 1984

COMPONENT AND AUXILIARIES  
MANUFACTURE FOR THE SHOE AND OTHER  
LEATHER PRODUCTS INDUSTRY  
IN THE DEVELOPING COUNTRIES \*

by

Ferenc Schmel  
UNIDO Consultant

---

\* The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

Table of Contents

	Page
INTRODUCTION	
Background	1
Objectives of the Study	2
Special Considerations	2
1. THE MODERN LEATHER PRODUCTS INDUSTRY	
1.1. Features of the manufacturing processes	4
1.2. Specialization and co-operation	5
1.3. The role of standardization	5
1.4. Product development	6
2. SPECIFICATION OF COMPONENTS AND AUXILIARY MATERIALS	
2.1. Terminology adopted by the study	7
2.2. Classification of components and auxiliaries	7
2.3. Materials used for components	8
2.4. Range of components and auxiliaries, which may be prefabricated in developing countries	10
3. MANUFACTURE OF SELECTED COMPONENTS' TOOLS AND AUXILIARIES	
3.1. Basic accessories for manufacturing	
3.1.1. Shoe lasts	12
3.1.2. Patternmaking	14
3.1.3. Cutting dies	15
3.2. Leather based components	
3.2.1. Woven leather	16
3.2.2. Shoe uppers	17
3.2.3. Insoles	19
3.2.4. Stiffeners	20
3.2.5. Welts	21
3.2.6. Assembled unit soles	22
3.3. Plastic components	
3.3.1. Heels, top-pieces	23
3.3.2. Moulded unit soles	23
3.4. Metall Working	
3.4.1. Fittings for leather products	25
4. MANAGEMENT OF COMPONENT MANUFACTURING	
4.1. The product range	26
4.2. Marketing aspects	27
4.3. Production management	28
4.4. Standardization	30
4.5. Training	30

	Page
5. CONCLUSIONS AND RECOMMENDATIONS	
5.1. Conclusions	31
5.2. Recommendations	32
ANNEX 1: ABBREVIATIONS USED IN THE STUDY	33
ANNEX 2: TERMINOLOGY OF MATERIALS, AUXILIARIES AND COMPONENTS USED FOR LEATHER PRODUCTS MANUFACTURE	34

## INTRODUCTION

### Background

Shoes, bags, gloves and similar leather products were traditionally made entirely of genuine leather. All leather product components and a substantial part of auxiliaries were produced by the leather products manufacturer himself. Although in some instances a few components of leather products had been made of materials other than leather (e.g. wooden soles in China and Japan), the replacement of genuine leather components started in the first half of the 20th century. The rapid increase in demand for various leather products after the industrial revolution, called for more intensive industrial activity, i.e. the productivity of hand working craftsmanship was no longer sufficient to meet the needs of new urban markets. In shoe factories, the technological process was split into specialized stages and operations, with the consequence that manufacture of some components was undertaken in specialized workshops. The basic materials suppliers also introduced confectioning units within their plants in order to produce components ready for assembling. This led to the present structure of the leather and leather products industry, which is a fairly complex network of different suppliers providing materials and ready made product components.

Most developing countries who have considerable livestock populations have started to develop their tanning and leather products industry. In many cases their attention was focussed on establishing individual tanneries, leatherboard mills, footwear and leather goods factories, and the supply of components and auxiliaries is obtained either by their manufacture within the leather products or by importing them from industrialized countries. Therefore it is a normal practice in developing countries to have a shoe factory producing most of the necessary components (e.g. stiffeners, insoles, soles) in its own plant, while some other components (e.g. heels, unit soles) and tools (lasts, moulds, etc.) are imported from Europe or North America. The drawbacks in both cases are straightforward. Productive autarchy is not efficient, and investments in leather product manufacture are higher than those required by relatively specialised manufacture. Imports of components of auxiliaries require foreign currency and are time consuming, hence place burdens on the working capital required to operate leather product manufacturing units.

### Objectives of the study

The main objective of this study is to present relevant data on material inputs, investment requirements and outputs of viable component and other auxiliaries manufacturing units. The survey examines the basic conditions which are necessary for starting nationally or regionally centralized component manufacture. At the same time it indicates the selective range of items which may be produced in developing countries at an acceptable quality level.

On the basis of a thorough analysis the most important basic elements (lasts, patterns and cutting dies), leather based components (woven leather, shoe uppers, insoles, stiffeners, welts and leather unit soles), some plastic fittings and metallic accessories (fittings) have been selected as possible candidates, the manufacture of which may be organized in certain developing countries. The possible manufacture of these components is discussed on a component by component basis but it can be set up as workshops for new plants, the product mix of which will be determined by local or regional needs. Thus the interested countries (or subsectors) have the opportunity to evaluate production possibilities according to their requirements, using the most appropriate combination of products or co-operation pattern.

The study is made chiefly for those concerned with decisions regarding technical development of the leather and leather products sector. It is hoped, however, that the information presented will also assist in preparing opportunity studies, as well as marketing and product development strategies.

### Special considerations

Since each country and region in the world has its unique geographic, socioeconomic, institutional and industrial conditions, as well as different local resources of materials and labour and prospects for regional co-operation and trade, it has not been possible to select any group of developing countries as a typical example for the development of a footwear auxiliaries industry. Therefore a more general approach is adopted, which sheds light on the technical and economic aspects required for efficient tooling and component supply for leather products manufacturers in developing countries.

The data (especially those of prices and costs) provided in the present opportunity studies of component manufacturing are estimates. Obviously, final investment (or possible co-operation) decision will require more elaborate and detailed feasibility studies, using exact data as to costs, offers, wages, taxes, fees, etc.



A number of abbreviations are used in this study. An explanatory list of abbreviations is provided in annex I.

The costs of plant and equipment provided in the following pages are FOB prices. Indicative figures of capacities and labour requirements are calculated on the basis of single shift work.

## 1. THE MODERN LEATHER PRODUCTS INDUSTRY

### 1.1. Features of the manufacturing processes

The leather products industry, especially footwear manufacturing has developed into a kind of assembly industry over the past 15 - 20 years. Medium and small-scale manufacturers are no longer producing components such as insoles, stiffeners, heels, welts, unit soles for shoes, linings for leather goods etc. In some cases they do not make patterns (e.g. for hand-cutting, stitch marking, quality control) and not even shoe-uppers. In the larger manufacturing units, these components are sometimes manufactured within the plant, but in separate specialized workshops using separate equipment and working methods. Cutting and perforating dies and simpler types of moulds are also produced in larger factories in special workshops usually attached to the maintenance department.

Lastmaking is generally a centralized manufacturing process because of its uniqueness and because of the determinating role of shoe lasts in footwear manufacturing. Lasts are regarded as the starting point, not only for styling and pattern engineering, but also for co-ordination of prefabricated components. Thus lasts provide special kinds of standards, serving as a database for sizing and constructing uppers, insoles, counters, heels, unit soles, etc.

It is not infrequent to witness tanneries and leatherboard mills producing confectioned components (e.g. welts, leather unit soles, insoles, stiffeners), in order to increase the manufacturing value-added of皮鞋. A similar trend applies to some metal works who manufacture nails, wires for staples, eyelets, rivets, fittings for leathergoods and steel shanks; some textile companies producing impregnated interlinings, threads, laces, zippers and plastic works supply blocks for lasts, shoe heels, top-pieces, unit soles, not melts etc. Nevertheless these items are most often manufactured by specialized companies, which supply these components ready for assembly into shoes, leather goods, gloves and leather garments.

Uppermaking in the shoe industry and lining assembly for handbags and gloves remained the most labour intensive process in this subsector, and the manufacture of these components needs simple but fairly universal equipment (mostly sewing machines). This provides the possibility of producing uppers and linings outside of a shoe, leathergoods or glove factory - sometimes even as a cottage industry. Therefore, in a considerable number of countries, moccasins, slippers, sandal uppers, and linings are produced

on a subcontract basis or purchased from manufacturers other than the leather products sector, or imported.

### 1.2. Specialization and co-operation

When certain components are supplied for leather products in ready form for assembling, i.e. when these items do not need operations other than attaching (sticking, rivetting, stitching etc. ) to the final product, there is a strong need for co-ordination of sizing and range-building. That requires a specialization on the part of the component manufacturers and a well organized co-operation among them and the leather products manufacturers.

In general there are two types of specialized component manufacturers. One type undertakes the manufacture of basic materials as has been mentioned above. The other group of suppliers operate specialized factories, which purchase all the necessary materials (leather, leather board, metal straps, compounds, yarn, etc.) and produce components and auxiliaries for leather products manufacturing companies.

The co-ordination of the component suppliers' activity with their customers have various forms. In most cases market trends and fashion force the component manufacturers to produce what is demanded by the shoe, leathersgoods, gloves, etc. factories. The largest leather product manufacturers (e.g. Bally, Bata, Clarks, Del-Sey, Gabor, Genesco, Salamander, Samsonite, Svit) have their own component making units, which sometimes can sell their products to other companies or export their production. In some socialist countries (e.g. Bulgaria, GDR, Poland, USSR) combines have been established in which centralized toolmaking and component prefabricating units provide services and supply the leather product assembly industry.

There are companies in industrialized countries (e.g. Avalon Supplier) who sell complete packages of basic footwear manufacturing prerequisites, consisting of lasts, insoles, and heels, in this way ensuring the co-ordination of these items.

### 1.3. The role of standardization

The guarantee for matching prefabricated components rests in various standards which prescribe size-ranges, grading-rules (tables), measurements of certain parts of components and tools, combination of sizes for components, correction of measurements, master curves and forms etc. These usually comprise a set of tables, equations, constants and parameters, patterns etc., which are sometimes published or adopted by national standards organizations (chiefly in centrally planned economy

countries).

There are two main types of standards followed by the leather products industry. The major end-product manufacturers usually elaborate and follow their own standards. In this case, they provide their last and component suppliers with the necessary numeric data and patterns to which the order items must conform. The other case is more common, i.e. instances when components suppliers produce according to their own standards. The basis of these standards is established by the last manufacturers, thus the last standard is reflected to a considerable degree in other components. Most well known component suppliers are prepared to produce insoles, heels, counters etc. according to a number of different standards (if ordered and specified), but more often they adopt the standards required by a particular last manufacturer.

It is evident that without component co-ordination leather products and especially footwear manufacturing of even the lowest mechanized level could not be successfully sustained. The simplest way to ensure co-ordination in the shoe industry is to specify a last supplier or to provide two lasts of adjacent sizes to the component supplier, which would enable the latter to design and produce matching components. It is also quite usual that a set of moulds for direct soling (injection or compression moulding) serves as a starting point for lastmaking, and producing of insoles and stiffeners.

#### 1.4. Product development

The operating method outlined above suggests that contemporary leather product development (including styling, pattern making, product engineering) is fairly different from the practice of a few decades ago, or that adopted by many factories started up recently in developing countries. Today, the construction of a new model may be regarded as a result of co-ordinated activities by several sectors. The following, simplified sequence of activities outlines the features of product development techniques adopted by leather products manufacturers in industrialized countries:

- i) Study of the recent fashion trends, the market and price development;
- ii) Decision on the main ranges to be developed with special references to function, price brackets and quality standards;
- iii) Selecting the last shapes to be used for the chosen range, taking the shell (only in case of footwear);
- iv) Selecting the basic material for the shoe upper (seldom for lining at this stage or leathersgoods or gloves or all of them if they are to be produced as a set);
- v) Styling and pattern-making for the leading models or selecting samples ("pull-overs") from the offer of modelling-studios and construction of patterns (for middle sizes in case of footwear,

- gloves, leather-garments);
- vi) Selecting components, i.e. stiffeners, insoles, heels, unit soles decorations, laces, etc. (for shoes) reinforcing components, locks, frames, rivets, eyelets, rings etc. (for leather goods) buttons, buckles (for gloves and leather garments);
  - vii) Product engineering, i.e. testing of the components, analysis of the model construction and costing;
  - viii) Evaluation of aesthetics, marketability, comfort, costs, material and labour requirements of the new style;
  - ix) Correction of the construction (material composition, lines, component-co-ordination etc.), as necessary;
  - x) Grading of patterns for footwear, gloves and leather garments;
  - xi) Tool-making for the respective operations (dies or banded patterns for cutting, moulds for backpart forming etc.).

As this procedure suggests, a new style is constructed on the basis of components, from the design stage itself, and the styling of important components is the responsibility of components manufacturers and suppliers.

A component designer from the footwear and/or leather products manufacturing sector has, however, influence on the design of the components and is often the originator of new special styles and trends in the component manufacture.

## 2. SPECIFICATION OF COMPONENTS AND AUXILIARY MATERIALS

### 2.1. Terminology adopted by the study

The range of composite and auxiliary materials used by the leather products industry has become extremely large over the last 30 years. A pair of shoes usually utilises 30 - 50 components made of different basic materials. Even the simplest types of bags or flat goods consist of parts made of genuine or simulated leather, textile, cardboard, metals and plastics.

Some of the materials and/or components form important parts of the leather products' construction (e.g. main body, frame, outer or lining part, sole, reinforcing), or keep together the different components (e.g. adhesives, threads, nails, rivets) or are required by certain technological operations (e.g. finishing) or used for increasing the aesthetic value of the end product (e.g. decorations, eyelets).

Given this variety of composite elements of leather products the terminology used by the technical literature and the market is far from uniform. In order to avoid misunderstanding and misinterpretation of the statements in this paper a brief list of terms used frequently in the study and their definitions are provided in Annex II.

### 2.2 Classification of components and auxiliaries

The grouping of materials, components and auxiliaries used in the leather products industry may be based on various criteria. They could be classified according to the type of basic materials used in their manufacture, or by the

end-product for which they are used or by their sizes, etc. Annex II also presents one way of grouping these items.

Fig.1 presents a classification of the main components of various leather products. This systematization serves the purpose to exhibit those components, which may be prefabricated to the stage ready for assembling. As far as auxiliaries, fittings, tools and patterns are concerned, Annex II indicates a grouping made according to the same principle. Most of these items can be manufactured centrally for a number of leather products manufacturers.

### 2.3. Materials used for components and auxiliaries

Due to the large variety of components, fittings, tools and patterns the list of basic materials used for their manufacture is fairly long. In most cases alternative materials can be used for the same component, or fitting, but the quality of the item in question depends on its material composition. As a consequence, components and auxiliaries made of different materials are generally used for different kinds of leather products (e.g. insoles with injected shank are used for high heeled ladies fashion shoes, while for sandals or sports shoes simpler insole constructions are more readily acceptable).

Genuine leather is no longer the only basic material for components (except leather unit soles) and it is never used for the other items mentioned above. Since metals, plastics, leather and cardboard has not been used traditionally in leather products manufacture, the processes and techniques applied in the manufacture of components and auxiliaries are the same as developed and adopted by the metallworking and packaging industries. The only item which utilises traditional technology is lastmaking: plastic blocks are turned and fabricated into shoe lasts exactly the same way as wooden ones used to be earlier.

All these circumstances indicate that leather component manufacturing processes do not require any traditions in leather products manufacture, therefore such production units for such products may be established outside the leather products industry. However marketing, product development and production management require substantial knowledge (know-how) of the requirements of the leather products industry, e.g. the co-ordination of lasts, components and moulds or grading systems in footwear component fabrication.

# COMPONENTS

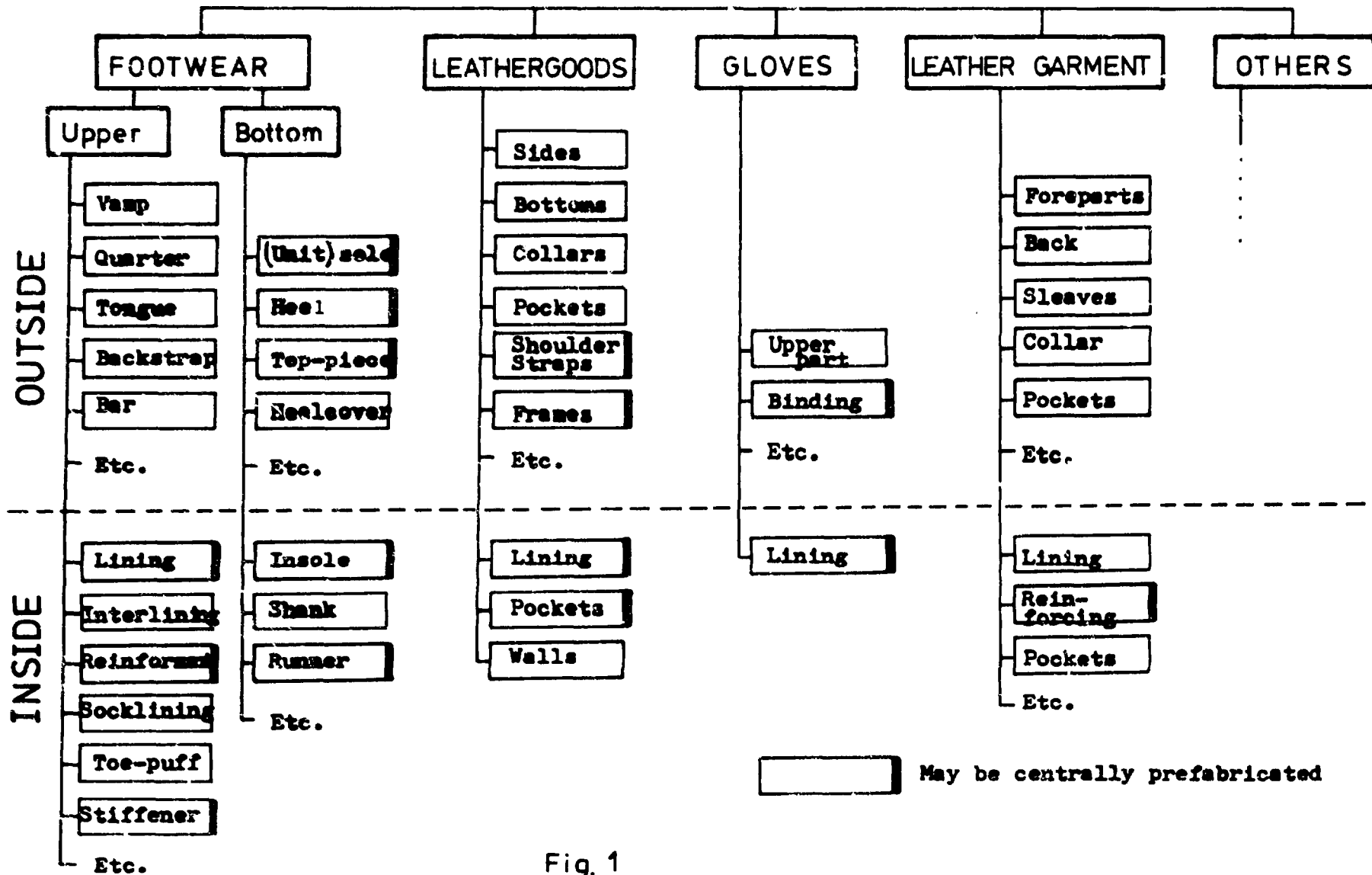


Fig. 1

2.4. Range of components and auxiliaries, which may be prefabricated in developing countries

The wide range of tools, components, auxiliaries, and fittings involves almost the same range of techniques. At the same time it would be uneconomic to start up the production of all kinds of these materials and equipment in developing countries, because:

- i) even the minimum economic plant size would have too large an output to conform to effective market demand (e.g. zip-fasteners, binding tapes, dye-stuffs);
- ii) some of the auxiliary materials need special basic materials or manufacturing techniques (e.g. nails, machine tacks);
- iii) some other auxiliary materials are protected by patents (e.g. adhesives).

Several components would be uneconomical for production in developing countries, because of the product range in the region (e.g. insoles with plastic shanks) or because of the special nature of basic material available locally (e.g. wooden lasts).

These considerations considerably narrow the range of items to be dealt with in this study.

Taking into account the relevant techno-economic conditions (specified briefly when the respective components or auxiliaries are discussed in the following paragraphs) the items listed below are worth closer examination:

- i) patterns,
- ii) shoe lasts,
- iii) cutting and punching (perforating) dies,
- iv) woven leather,
- v) shoe uppers,
- vi) insoles,
- vii) stiffeners,
- viii) welts,
- ix) heels and top-pieces
- x) unit soles,
- xi) laces,
- xii) fittings.

Table 1. provides an approximate idea of the range of basic materials which may be used for these items and indicate at the same time the variety of components which are examined as prospects for production in developing countries.





### 3. MANUFACTURE OF SELECTED COMPONENTS' TOOLS AND AUXILIARIES

Since even the selected items belong to a fairly wide range of auxiliaries, the following grouping is adopted:

- i) basic accessories for leather products manufacturing processes, serving as the most important elements for ensuring quality co-ordination in assembly (shoe lasts, patterns, cutting dies);
- ii) leather based components, i.e. composite elements made of leather or leather-like materials (e.g. leatherboard);
- iii) plastic components made of PVC, polystyrene, polypropylene, polyethylene, PUR etc.;
- iv) metallic fittings.

#### 3.1. Basic accessories for manufacturing

##### 3.1.1. Shoe lasts

Shoe lasts traditionally have been made of hard wood, mainly maple, beech, and horn beam. Wood needs seasoning, which requires a long time and steaming/drying chambers, wood lasts are not sufficiently durable and precise and their manufacture is influenced by climatic conditions. Due to these disadvantages, wood has largely been replaced by plastic for bulk last manufacture, while wood is used only for model-making.

The most widely used basic material for last manufacture is polyethylene. High density polyethylene provides better properties (e.g. durability, hardness retention, and crushing strength), and therefore is preferred by a number of last manufacturers in industrialized countries. Some last factories mix high and low density polyethelene, however, the quality of lasts is lowered by the increased proportion of low density materials used. The world market price for high density polyethelene is about U.S. \$ 1/kg while the low density compound or granulate is about 30 - 35% cheaper.

Almost all last manufacturers produce their own blocks; although this requires an investment in an extruder and a granulating unit which together cost US \$ 130,000 in addition to moulds which cost US\$ 1,600/pair. 2.2 - 3.5 kg polyethelene is required to make one block, and of this 45-50% remains in the lasts. Most of the wastes may be recycled, regranulated and added to the virgin basic material. The average output of an extruder is 500 - 700 pairs per eight hour shift, depending on the size range.

The majority of plastic lasts are hinge (spring) types, with the bottom being partly or fully iron plated. Footwear manufacturers need 50 - 300 pairs of lasts for each new style they introduce into production. Shoe factories

seldom place replacement order for old styles (however in case of low density poly-ethelene this may happen more frequently), thus the bulk of lasts manufactured are in new shapes requiring considerable efforts in design, pattern and modelmaking. The world market price of heel plated lasts made of high density material is U.S. \$ 12.50 - 17.00/pair plus extras (e.g. extremely large sizes, slot in toe, bevelled edges for Weltshoen technology) making about U.S. \$0.7-1.5/pair. Last manufacturers charge U.S. \$ 50 - 80 per style for modelling, but this amount is usually refunded when at least 50 pairs are ordered. The delivery time is 3 - 5 weeks. Transport costs (in case of about 7,000 km) are U.S.\$ 0.3-0.4/pair by sea (requiring 4-6 weeks) and U.S. \$ 3.0-3.5/pair by air (requiring 2 - 4 days).

The main operations required by plastic last manufacture are the block extrusion and cooling, cutting the forepart and the backpart of blocks, rough turning, link cutting, hinge slotting and setting, fine turning, taking off dogs, heel shaving, setting the ferrule and thimble, plating and marking. Markers play a key technological role since they are the only means for checking the preciseness of lasts.

The following three variants of manufacturing units may be considered as economical approaches when starting last manufacturing:

- A) 100 pairs/8h output of lasts, when plastic blocks are supplied from a petrochemical plant and only the most important operations are performed by machines;
- B) a semi-mechanized unit producing 250-300 pairs/8h when the extrusion is done within the last factory;
- C) a mechanized last production unit with an output of 500 pairs/8h and using up to date machinery for all operations.

In all cases a pattern grading unit or similar service is required. Rough and fine turning machines, one band-saw, an exhausting system, steelplate cutting machines, a drilling and a buffing machine are indispensable as well. Combined rough and fine turning machines need sophisticated maintenance, they are more complicated to operate and wear fairly quickly in continuous heavy use, at the same time cost almost as much as pairs of rough and fine turning machines.

The following figures provide an indication of the production and input requirements of each of the three variants.

	(A)	(B)	(C)
Output, pairs/8h	80 - 100	250 - 300	450 - 500
Equipment, US \$	80,000	250,000	600,000
Working area, m <sup>2</sup>	200	600	1,000
Direct labour	25	65	90
Electric power, kW	10	60	75

Beside the main manufacturing facility, each lastmaking unit needs a model making department. One model maker can produce between 150 to 350 new styles annually, depending on the co-ordination system applied. Owing to the distortions of shapes and forms, which may account for lasts of very small and very large sizes, usually three models are used for developing a whole size range, and this requires extra model making.

Equipment for last manufacture are supplied by Donzelli, Fagus, Incoma, Seidl and Zuckermann; they offer complete plants as well.

### 3.1.2. Patternmaking

In mechanized production it is not possible to manufacture shoes without prior pattern making. Patterns are necessary for quality control, cutting die making or hand cutting, stitch marking and manual edge folding. The role and accuracy of patterns becomes increasingly important at higher levels of mechanization or automation. In mechanised shoe production patterns are required for programming automatic stitchers, controlling the roughing machines etc. Properly designed and engineered patterns serve as technical documentation on new styles and provide certain technological information for production. Further the basic set and the graded series of patterns, represent the standard for co-ordination of shoe and leather garment components.

Leathergoods (handbags, luggage, wallets, etc.) are usually manufactured in one size, the patterns are created by the designer and used only for that particular style or product. In many cases manufacturers adopt standard components (e.g. pockets, zip-fasteners), which means that they use the same cutting dies for quite some time, therefore patterns are not required for these items. In glove manufacturing, standard dies (so called calibers) are used, although graded, but bought from well known, reliable suppliers (e.g. Porkert, Hauser and Renner).

Leather garment patterns are made of hard paper and used for cutting only. The grading is made manually even in most of the factories in industrialized countries, using traditional techniques adopted by the textile apparel industry.

Pattern making has developed into a unique and highly appreciated technique in footwear manufacturing. While designers usually create new styles, producing only the basic shell and patterns for the middle size of a line, pattern cutters are engaged with the pattern engineering, pattern grading, component co-ordination, tool engineering. The patterns themselves are generally made of paper, hardboard, metal or plastic sheets - depending on the size of the production, their functions. Most frequently hardboard patterns binded by moulded metal strips are used for hand cutting, which is the only economical operation when short runs are manufactured.

The following equipment is essential for rational pattern making:

- cutting block
- set of designer hand tools
- pattern vice
- pattern shears
- pattern grading machine (two-arm pantograph)
- pattern binding machine.

To make the work more precise and comfortable special handtools, auxiliary equipment (e.g. punching press, marking device) and machines (pattern binding moulding, buffing) might be introduced. Such equipment may be obtained from Albeko, UCICA, SIDECO, Pedersen, USM, Ovic Lince.

A typical pattern making workshop can produce about 600 - 800 complete sets of graded patterns yearly (the output chiefly depends on the number of components of styles). For this the following conditions are required:

- investment for equipment, US \$	12,000 - 20,000
- working area, m <sup>2</sup>	100 - 140
- labour	5 - 8
- electric power, kW	2.0

It should be mentioned, that equipment manufacturers are offering computer controlled pattern cutting machines, whose costs range from US \$ 70,000 to US \$ 300,000.

The material requirements for ordinary styles is approximately 0.2 - 0.3 m<sup>2</sup> of sheet material for each size and copy. In case of binded patterns for hand cutting - about 4.0 - 4.5 m of binding strip (width: 4-6 mm) is needed. No specific auxiliary materials or utilities are required. The throughput time may vary from one day to one week.

Grading is fairly expensive in industrialized countries; e.g. a complete size range of last bottom patterns made of hardboard costs approximately U.S. \$ 14 - 20.

### 3.1.3. Cutting dies

There are two kinds of cutting dies used in the manufacture of footwear, leather goods, and technical articles. The majority of dies today are formed from steel strips which have cutting edges on one or both sides (in case of double edged dies there is no need for separate left and right ones). The bending process is fairly simple, made by relatively cheap equipment. The strips are cold bent and the dies have a maximum height of 50 mm. Closing and reinforcing of dies is done by electric welding. Electrodes used for high frequency welding of simulated leather are made in the same way.

Forged dies are heavier, usually have about 100 mm height, and are made by traditional forging. As a consequence, they are more durable, retain their shape, edges and sizes longer than bent dies. These type of dies are necessary for cutting of heavy materials (leather board, rubber sheets) or textiles and simulated leathers in several layers.

Four different levels of mechanization may be considered when a new diemaking unit is to be established:

- A) minimum equipment for 6,000 pieces/year cold bent die manufacturing;
  - B) semimechanized workshop for making cold bent dies up to 50 mm height at a capacity of 15,000 pieces/year;
  - C) fully mechanized unit for all kind of cold bent cutting dies and welding electrodes manufacturing, having capacity of 50,000 pieces/year;
  - D) forged dies manufacturing workshop for 1,000 pieces/year.
- (However, the variant "D" may be combined with any of the first three alternatives).

The equipment required for a diemaking unit is: steel shears (manual or hydraulic), bending machine (foot-operated or hydraulic) with table, grinding machine, heating torch, electric welding apparatus with fixtures, pricker press. Auxiliary equipment and tools such as material clamping plates, steel stamps, code marking apparatus, broaching tools, pattern clips, knife dresser, repair set, material barrel and bending tools make the workshop more complete and perfect. The major suppliers of equipment and materials for diemaking are Skomas and Sandvik.

The following figures are estimates of the techno-economic parameters of the above mentioned diemaking units:

	(A)	(B)	(C)	(D)
Cost of equipment, US \$	8,000	30,000	70,000	20,000
Working area, m <sup>2</sup>	100	180	250	150
Labour	3	10	18	5
Electric power, kW	3	4	8	10 - 20

The price of 1 m special steel strip (imported from industrialized countries) is US \$ 3.00-6.00, i.e. the average cost of materials (including auxiliaries) for preparing a complete set of an average footwear cutting die for a new style is about US \$ 200-300 depending on the type of the die. (For comparison: a single of forged cutting die made in industrialized countries costs US \$ 35 - 40).

### 3.2. Leather based components

#### 3.2.1. Woven leather

In the international market, shoes made of woven leather uppers represent a fairly expensive product type, although the market share of such shoes is not too large. In the manufacture of woven leather, exciting aesthetic effects may be achieved by mixing various colours, using different weaving patterns, or cutting the woven sheet in different directions. Owing to the high material and

labour content, footwear manufactured by this type of material is not too economical to produce in industrialized countries. The production of woven leather by cutting leather into narrow strips enables the "elimination" of the more obvious surface faults of the leather used. This prospect makes the manufacture of woven leather especially interesting for those developing countries where the quality of the locally available raw hides and skins prevents the production of more valuable leather.

Two rather extreme possibilities can be considered for those intending to start the manufacture of woven leather. One of them requires no special machinery (provided the leather used has more or less constant thickness or it has already been splitted), but it needs a tradition and skills based on a handicraft sector.

The other option is to introduce a special manufacturing unit capable of cutting the leather, splitting the strips and weaving the leather. The complete equipment for this option consists of a helical leather strap cutting machine, a skiving machine, a bobbiner and a weaving machine, the sticking of straps at their ends may also be done by a special purpose machine. The output of such a unit is about 5 m woven material of 720 mm width hourly, which is sufficient for 12-14 pairs of woven vamps for gents shoes. The techno-economic data are:

- cost of equipment, US \$	45,000
- working area, m <sup>2</sup>	130
- labour	3
- electric power, kW	1

The machinery is available from Kadic along with the related know-how.

One pair of footwear made with woven upper retails in industrialized countries for US \$ 40 - 70 and above.

### 3.2.2. Shoe uppers

Despite the facts that mechanization and automation has changed considerably in footwear manufacturing, and some fairly sophisticated machines appeared on the equipment market, the closing rooms of shoe factories are not very different from those used 20 - 30 years ago. Uppermaking remains the most labour intensive process in shoemaking, with the result that upper manufacture in industrialized countries has become quite expensive.

A considerable number of shoe factories in developing countries have entered the international market by supplying uppers for European or North American companies, and then gradually developing their own finished footwear exports. Such type of trade provides advantages for both developed and developing countries.

The shoe upper supplier from a developing country obtains fashion information, technology, production standards, experience in production management and, of course, higher foreign currency earnings.

Shoe upper manufacturing in developing countries needs locally available basic materials - the most important of which is chrome tanned and finished leather, or in exceptional cases, upper textiles. Uppermaking involves cutting, component preparation and assembly of uppers. The most economically produced uppers, from the developing countries point of view, are those made of materials available locally, and require a high labour content (e.g. hand stitched mocassins).

There are three variants of uppermaking units, which may serve as starting stages for upper manufacturing:

- A) hand cutting, using only simple sewing machines, hand stitching and simple auxiliary equipment;
- B) semi-mechanized unit, using machines for cutting edge folding, rivetting and marking and some special sewing equipment (post bed, binding, zig-zag and double needle machines);
- C) fully mechanized cutting and closing workshops, but still without any automation.

The following figures are rough estimates of the techno-economic parameters of these units:

	(A)	(B)	(C)
Output, pairs/8h	200	300-500	800 - 1000
Equipment, U.S. \$	25,000	60,000	140,000
Working area, m <sup>2</sup>	120	200	400
Labour	17 - 20	30 - 35	45 - 70
Electric power, kW	5	20	50

Sewing machines are supplied by Adler, Bernina, Singer, Pfaff, Necchi, Investa Brothers, Technoimpex, Textima. Beam cutting presses and swing arm clicking presses are available from Atom, BUSM, Sandt, Anver, Cheng Fen, Ellegi, Schön, Technoimpex; other equipment for upper manufacturing (e.g. marking, edge folding, skiving, eyeletting, splitting) are manufactured by BUSM, Anver, Albeko, Comelz, Ellegi, Sagitta, Camoga, KAEV, Sorensen, Fortuna, WSK.

There are instances in some developing countries where the cottage industry is involved in upper manufacturing. The experience in this sector during the last decades is rather unpromising as a result of the uneven product quality and long delivery times.

Another possibility might be to produce textile shoe uppers. The disadvantage of this type of production is the need for special textiles and the relatively



high mechanisation level requiring greater investments in plant and machinery. On the other hand, textile uppers may be manufactured in textile garment factories. An important shoe upper type in today's market is the "jogging" shoe made in textile, leather and/or simulated leather combinations.

### 3.2.3. Insoles

Genuine leather insoles have been to great extent replaced by leatherboard combined with backerboard or plastic backpart. Insoles used in strap sandals usually have a "skeleton" on the bottom side, with a bound edge. Insoles of casual shoes may have a soft layer ("footbed") covered by a special sock lining. The machine velted technology requires special ribbed insoles.

The basic material of premanufactured insoles is leatherboard or cellulose board used for the forepart or in some cases for the whole component. The backpart often is made of backerboard reinforced with steel shank for higher heels. The other possibility is to inject polyethylene into the split backpart of the celluloseboard or leatherboard insole.

The technological sequence of operations and the machinery required basically depend on the insole construction. Two extremely efficient and practically semiautomatic production lines are available on the world market:

Supplier of the line:	<u>Morbach</u>	<u>Plastak</u>
Insole construction:		
- basic material	leatherboard or celluloseboard	leatherboard or cellulose
- shank	backerboard and steel	injected polyethylene
Output, pairs/8h	7,500	6,000
Investment, U.S. \$	80,000	320,000
Working area, m <sup>2</sup>	180	230
Direct labour	3	.6
Electric power, kW	12	30

These two lines of equipment are fairly sophisticated in operation and require considerable servicing and maintenance and special tooling. The high production capacity and investments requirements make them inappropriate for developing countries, unless they have sufficiently large shoe production in the country or region and locally manufactured leatherboard is available. Another similar process is offered by Anver for moulded and sock covered "footbeds" using a high frequency machine.

There are more suitable alternatives, which do not need advanced technical infrastructure, and which may be more readily adapted to

conditions prevailing in developing countries. The insoles produced by these techniques are made of genuine leather, leather board or cellulose board with hardboard or second layer of leather board, reinforced by a steel shank for high and middle heel heights. If the forepart of the insole is cut only very roughly (leaving the exact trimming for the shoe manufacturers according to the actual toepart of the last used), with completely finished backpart, the market for prefabricated insoles can be considerably expanded, even in countries which have small-scale footwear manufacturing as opposed to large factories.

The most important operations of traditional insole premanufacture are cutting of insoles and shanks, sticking them together with the steel shank (if any), moulding and beveling under the heel. The following alternatives may be considered as minimum economic capacities:

- A) minimally mechanized unit using only swing arm clicking, skiving, moulding and seat beveling machines, while all other operations are performed manually;
- B) semi-mechanized unit, having (in addition to the equipment mentioned alternative "A") special equipment for producing strips composed of leatherboard and hardboard, slotting, reducing (profile splitting), and marking, binding/edge folding.

The parameters of such production units are:

	(A)	(B)
Output, pairs/8h	800	2,500 - 3,000
Investment, U.S. \$	12,000	80,000
Working area, m <sup>2</sup>	150	350
Direct labour	10 - 12	10 - 12
Electric power, kW	7	12

Possible equipment suppliers are BUSM, CIC, Ralphs, Anver, Schön, UCICA, SIDECO/Torielli, Sandt, Moenus, Morcbach, GerMac and Albeko..

One m<sup>2</sup> of leatherboard (2.0 mm thick) costs U.S. \$ 2.00, a pair of prefabricated insoles costs US \$ 0.50 - 0.80. Insole strips composed of leatherboard and hardboard are available for U.S.\$ 1.80 - 2.00/Strip (one strip is sufficient for 7 pairs of insoles).

#### 3.2.4. Stiffeners

Leatherboard for stiffeners is made with many types and grades of materials. However, leatherboards consisting of at least 60% of vegetable tanned fibers is appreciated as the best material. Such stiffeners are usually semi- or full moulded to facilitate heel- seat lasting. The other material used for

this component is bonded fiber coated with thermoplastic resins, which requires only skiving before inserting into the backpart of uppers. Beside these materials genuine leather, rubber and various plastics may be used, but utilisation is relatively infrequent.

Equipment suppliers (e.g. Cobmer, Hollinger, Svit) offer sophisticated complete lines for the manufacture of fully-moulded leatherboard stiffeners. Their output is at the magnitude of 15,000 pairs/8h, the cost of the machinery is about U.S. \$ 100,000 and the plant is operated by 5-7 direct workers. A more appropriate unit for developing countries may be selected from the following:

- A) manufacturing of semi-moulded counters coated with thermoplastic adhesives;
- B) producing fully-moulded counters coated with adhesive using a semi-mechanized workshop.

Stiffener prefabricating in developing countries may be efficient if locally manufactured leatherboard is available and several million pairs are required by the local footwear industry. The price of leatherboard suitable for stiffeners is about U.S. \$ 2.20/m<sup>2</sup>, while one pair of moulded stiffeners costs U.S. \$ 0.18-0.25 on the world market.

The indicative figures for the above described units are as follows:

	(A)	(B)
Output, pairs/8h	3,000	8,000
Equipment, U.S. \$	12,000	45,000
Working area, m <sup>2</sup>	80	200
Direct labour	5	7
Electric power, kW	7	25

The most important machines (cutting press, skiving machine, moulding machines with sets of moulds, equipment for coating with adhesives and drying) are available from most of the suppliers listed in paragraph 3.2.3.

### 3.2.5. Welts

Welts are not only used for veldtshoen and machine welted footwear constructions, but also - depending on fashion trends - are applicable in the case of traditionally cemented shoes. The basic material is still genuine leather, since PVC welts are used only for cheaper quality of footwear.

The range of welts is fairly wide. However, their manufacturing technique is almost exactly the same. The technological process comprises operations such as strap cutting (made spirally), skiving, notching, grooving and stitching (if required).

The output of machines performing consecutive operations in welt manufacture varies considerably. Strip cutting machines produce about 6,000 m/8h, while the production capacity of finishing operations range from 250 to 450 m/8h. The following figures provide an idea of the economics of welt production:

Product	(A)	(B)
	Plain Welts	Finished Welts
Output, m/8h	6,000	300
Equipment, US\$	8,000	32,000
Working area, m <sup>2</sup>	30	100
Direct labour	3	14
Electric power, kW	2	5

Machinery is available from UCICA, SIDECC, Anver.

World market prices of one meter of welt are approximately U.S. \$ 0.4-0.8 depending on the finish. (One pair of adult shoe if welted from heel to heel requires about 1.0-1.3 m.) The price of vegetable tanned genuine welt leather with buffed or coloured grain is U.S. \$ 25 - 30 /m<sup>2</sup>.

### 3.2.6. Assembled unit soles

Assembled unit soles made of vegetable tanned leather with plastic heels for gent's footwear cost U.S. \$ 2.00 - 4.50/pair on the world market depending on the quality and finish.

Some companies (Torielli, Bruggi, Albeko, Schäfer, GerMac) offer complete lines of equipment capable of producing 1,500- 3,000 pair/8h. Such plant

employs 8 - 15 direct workers, but costs about U.S. \$ 140,000. It needs a well managed maintenance and tooling service, and requires approximately 260 m<sup>2</sup> production area and 46 kW electric power.

A much less mechanized unit capable of working with genuine leather or resin rubber material would be a far better choice for developing countries. It would have machines such as a clicking press, splitting/reducing machine, edge trimming machine, Sole Edge Brushing machine and spray guns with exhausters. The most important parameters of this type of production unit are:

Output, pairs/8h	500 - 600
Equipment, US\$	20,000
Production area, m <sup>2</sup>	160
Direct labour	14 - 20
Electric power	12

The equipment for this type of production unit is available from Anver, Torielli, GerMac, Albeko, CIC Ralphs.

### 3.3. Plastic components:

#### 3.3.1. Heels, top-pieces

Heels built or stacked from leather lifts and top-piece firs have been mostly replaced by wood (beech) turned in the same way as wood lasts, rubber (for lower heel heights) and plastics. Today polypropylene and polystyrene dominate the market, since they are relatively easy to form, they are light and provide sufficient durability and crushing strength and they may be finished either by colouring or covering with upper materials.

The technological process of heel and top-piece manufacturing has become very simple. Granulated basic materials are melted and injected into moulds having the negative form of the heel, then cooled and dyed or sprayed. In case of higher heels and top-pieces for ladies shoes thimbles and nails are automatically inserted in the moulds, sometimes even the genuine leather heelcovers which replicate stacked heels are attached in the injection moulding process.

Equipment is available from Presma, Plastak and Kuasy, and costs approximately U.S. \$ 30,000. The price for a set of moulds is about U.S. \$ 400 - 600. One injection moulding machine may produce heels at a rate of 2,000-3,000 pairs/8h and top-pieces at a rate of 6,000 pairs/8h. One operator is able to serve several machines at the same time.

Plastic heels may be bought from suppliers in industrialized countries for U.S. \$ 0.45 - 0.60/pair. Polypropylene granulates sell for U.S. \$ 0.95/kg in Europe.

#### 3.3.2 Moulded unit soles and sheet rubber for the manufacture of pre-finished soles (as described under 3.2.6)

One of the possibilities of producing unit soles with lower and middle heel heights or sheet material for the manufacture of pre-finished soles is to introduce special vulcanizing presses, so-called "daylight" presses because of their tiered openings, with moulds for unit soles, heels and resin or micro-cellular rubber sheets. This type of equipment should preferably be installed at an existing rubber factory with rubber compounding capability, as the installation of rubber mixers such as inter-mixers and open two-roller mixing mills requires a heavy investment.

Rubber unit soles produced by this method are most suitable for shoe types which require extremely good wear properties (e.g. military boots and sport shoes). The resin rubber sheets and micro-cellular rubber sheets produced by this method are suitable and popular for many different types of footwear, from ladies high heel shoes to "jungle boots".

The production capacity of a daylight press varies depending on its size, number of daylight, type of moulds employed and the type of rubber compound used, especially the curing time. As an example can be mentioned that one 90 cm x 90 cm, six daylight press would be capable of producing approximately 1,200-1,600 pairs of unit soles in eight hours.

The other alternative is plastic moulding, which is a simple, but productive process. The equipment required is an injection moulding machine with moulds and a dyeing/colouring machine or device. In addition to that, however, machines are available for cooling, trimming overflows, roughing, regranulating, etc.

Most injection moulding equipment may be adjusted (having the necessary devices and components) either for unit sole manufacture or direct soling if required.

The following options may be considered as initial starting points:

	(A)	(B)
Basic material	PVC or TR	PUR
Output, pairs/8h	400-900	900-1,200
Equipment, U.S. \$		
- machine	30,000-50,000	80,000-100,000
- set of moulds	6,000-8,000	4,500- 6,000
Space, m <sup>2</sup>	120-160	180-300
Labour	4-6	4-6
Electric power, kW	15-20	20-28

Both kinds of units need supplies of compressed air of 0.3-1.0 m<sup>3</sup>/h at 12 bar.

Injection moulding machines are available from BUSM, Desma, Gusbi, Ottogalli, Lorenzin, Ferrari, Farraud, Anver, Bata Engineering, Svit, Elastogran. Most of these suppliers offer PVC/TR injection moulding machines ranging from 2 to 16 workstations, PUR injectors with mixing equipment usually with rotating table for 12-36 moulds, granulators, refrigerators and moulds. There are manufacturers specialised only for mould making (e.g. Siderstamp, Wieser, Compo).

The costs of basic materials in U.S. \$/kg are:

- PVC	0.90 - 1.20
- TR	1.40 - 1.80
- PUR (resin-mix and pre-polymer)	1.60 - 2.00

(A pair of unit soles for adult footwear weights about 0.3 - 0.6 kg if expanded, or 0.7 - 1.2 kg if it is compact). The prices of coloured unit soles on the world market vary according to their mass, basic materials and size groups. The following figures are to indicate the magnitudes and ranges.

	U.S. \$/pair		
	PVC	TR	PUR
Children	0.5 - 0.8	0.8 - 1.2	1.0 - 1.5
Ladies	0.7 - 1.2	1.9 - 1.6	1.5 - 2.0
Men	0.8 - 1.5	1.5 - 2.0	1.4 - 2.2

### 3.4 Metall working

#### 3.4.1. Fittings for leather products

Buckles, hooks, locks, tangs, corners, rings, bottom nails, buttons and decorations may be made of either sheet metals, alloys or plastics, while eyelets, push-buttons and rivets are always manufactured from metallic strips. Metallic fittings require similar equipment used in metalworks (e.g. presses, stamps) where plastic and alloy-based items are moulded. Both kinds of fittings need finishing, since they serve as decorative elements or components of leather products.

The following alternatives may be considered when a fittings manufacturing unit is planned:

- A) production of about 10 million pieces of buckles, decorations, rings and handle-holders, 150 million pieces of eyelets, rivets and hooks and 400,000 pieces of simple locks and tangs all made of metals, in a year working in one 8h shift;
- B) moulded fittings, 2 million pieces of buckles, corners etc., 0.5 million pieces of decorations and 3 million pieces of handles in a year, working in one 8h shift.

(Note: the production capacities are convertible, but the complexity of items must be taken into account when transferring the respective figures.)

Metallic fittings manufacture requires cutting, stamping, bending and mounting machines (all equipped with the necessary moulds and devices), a crab as well as an equipment for surface treatment by electrolysis. The moulds are fairly complicated, since they usually have several sections. The moulding workshop consists of an injection moulding machine, dyeing/colouring equipment and an oven for mould making. The moulds are made in this case from silicone.

Basic materials used are rolled metal strips or sheets, billets of alloys, polyethylene, polypropylene or polystyrene compound. The main quantitative characteristics of fittings manufacture are the following:

Fitting type	(A) Stamped	(B) Moulded
Output, million pcs./year	160	5
Equipment, U.S. \$	140,000	30,000
Production area, m <sup>2</sup>	240	100
Labour	3 - 10	4
Utilities		
- electric power, kW	45	14
- water, m <sup>3</sup> /8h	15	5
- gas, m <sup>3</sup> /8h	-	18 - 30

The prices of similar fittings imported from industrialized countries have a very wide range. The following figures are to give an idea about the prices of some middle quality items made of metals.

- eyelets, U.S. \$/1,000 pcs	0.5 - 1.2
- buckles, U.S. \$/1,000 pcs	1.6 - 4.5
- rivets, U.S. \$/1,000 pcs	3.5 - 6.0
- locks, U.S. \$/pcs	0.6 - 2.4

Fittings made of Zn alloy are about 20% and the plastic items 50% cheaper than the respective metallic ones.

#### 4. MANAGEMENT OF COMPONENT MANUFACTURING

As has been mentioned elsewhere, not all accessories should necessarily be produced locally; there are items which cannot be manufactured economically in developing countries or conform to the required quality. On the other hand, the efficiency of the above processes may be considerably increased, if they are combined with others or with some material manufacturing.

This section discusses the factors influencing the selection of items to be produced locally or regionally. There are also some particular "peripheral" conditions to which special attention should be devoted, and these are evaluated in the following pages.

##### 4.1 The product range

The first question to be examined and answered when deciding on erection of a plant for component and auxiliaries manufacturing is the product profile, i.e. which items would be economical to produce locally in order to replace imports. In addition to techno-economic aspects suggested by guidelines for feasibility studies, the following factors should have high priority in the investment analysis:

- (i) The size, product mix and orientation (export versus supply for the local market) of the leather products industry, which will be served by the components manufacturing unit(s);
- (ii) The size of the leather products industry in the neighbouring countries, which could form the potential market;
- (iii) The component, auxiliary materials and fittings similar to those used in the leather products industry, required by other manufacturers (i.e. the upholstery and apparel industries);
- (iv) Statistical data on import of components and auxiliaries over the past years;



- (v) Plans for developing the leather and leather products industries, and its future demands for components and auxiliaries;
- (vi) The enquiries and offers received from various sources regarding supply of shoe uppers or other leather products, co-operation in manufacturing of such items, etc.;
- (vii) Local availability of basic materials and/or semi-products such as plastic compounds, metal sheets or strips, vegetable or chrome tanned leather, leatherboard, cellulose, etc.;
- (viii) Local manufacture of plastics, leatherboard, fabrics, small metallic goods, etc.;
- (ix) Information and other services available from local or regional leather and leather products development centres;
- (x) Component manufacturing capacities established within the operating leather products factories.

Although there is no general rule on selecting components and/or auxiliaries, the safest approach is to concentrate on the cheaper and middle-priced items, provided the locally or regionally required quantities reach the minimum viable capacity of the respective unit, and to import the more sophisticated, delicate and high quality auxiliaries. For this reason, steel shanks, digital locks, nails and machine tacks were not mentioned in paragraph 3. These items require either very special basic materials or unique technology to be manufactured, which are available in only a few developing countries, today. The same applies to special tools, moulds and strips for cutting dies.

#### 4.2. Marketing aspects

As it has already been mentioned, the local industrial infrastructure is an important asset for component manufacturing. The following subsectors and/or operational units may be of great advantage:

- i) Leather manufacturing units for woven leather, shoe uppers, welts, and leather unit soles production;
- ii) Leatherboard mills for insole and stiffener prefabrication;
- iii) Textile factories for bindings, zip fasteners, lace supply;
- iv) Petrochemical and plastic industry for supplying basic materials for shoe lasts, patterns, heels, top-pieces, moulded fittings, welts, unit soles;
- v) Metallurgical plants: for the supply of alloys, strips or sheets for pattern making, shoe lasts, and fittings manufacture;

- vi) Metal works to assist or establish fitting manufacture, supplying auxiliary materials for last and heel production;
- vii) Paper mills supplying backerboards for backpart of insoles;
- viii) Dyestuff manufacturing plants supplying some of the finishing materials;
- ix) Rubber factories producing sheets for soles or to introduce compression moulded (vulcanized) unit sole and heel production, and for the supply of simple adhesives (i.e. latex, rubber solutions and neoprene adhesives).

The supply of basic materials is only one of the possible functions which may be performed by these industrial sectors. In many cases the existing production units in these sectors provide good opportunities for plant expansion in order to start leather products component manufacturing or prefabrication. Such an approach may considerably reduce the investment costs due to the availability of already existing utilities, energy supply, warehouse, in-plant transport facilities, administration and management services.

Since the minimum economic capacities are usually quite big compared with the requirements of the average scale of leather products manufacturing units in developing countries, sales promotion and pricing play a key role in the success of the component manufacturing. The management should make all efforts to co-ordinate different requirements as to the sizes, quantities and shapes of the products. It must also provide the users with the relevant information, catalogues, guidelines for technological applications, quality standards, etc.

#### 4.3 Production management

Several components, auxiliaries, tools and patterns may be attached to manufacturing units producing other items. Table 2 indicates these possibilities.

The plant capacities given in paragraph 3 for the discussed components, tools and auxiliaries are the minimum economic sizes. In case of combination with other items, the total investment, production area and labour is somewhat less than the arithmetic sum of the respective figures because of possible rationalization in utilizing the capacities of particular machines, auxiliary equipment, etc. The difference between the simple sums and the actual requirement may be up to 20-30 %. If a larger output is needed, the units may be multiplied.

Special attention has to be paid to the tooling of the production processes. If tools (cutting dies, moulds, etc.) are not precise, the components manufactured will not match and all advantages of prefabrication will disappear.

Table 2

Possible combinations of component and auxiliaries manufacture

Patterns	Cutting dies	Shoe lasts	Woven leather	Shoe uppers	Insoles	Stiffeners	Welts	Heels, top-pieces	Unit Soles		Fit-tings		Manufactured Items
									Assembled	Moulded	Stamped	Moulded	
	X	X						X					Patterns
X		X									X		Cutting dies
X	X				X			X		X	X		Shoe lasts
				X			X						Woven leather
			X										Shoe uppers
		X			X	X			X				Insoles
					X	X			X				Stiffeners
			X		X	X			X				Welts
X		X								X	X		Heels, top-pieces
					X	X	X						Assembled
		X						X				X	Moulded
	X											X	Stamped
		X						X		X	X		Moulded

In this industrial activity, storage forms another important consideration. A considerable stock of auxiliary materials (chemicals, dyestuffs), spare parts, basic materials are required to ensure undisturbed production. On the other hand, some ready goods are needed to provide prompt and continuous supply of different grades, styles, sizes, etc.

#### 4.4. Standardization

The role of standards and co-ordination was discussed in detail in paragraph 1.4., but its importance cannot be overemphasized. The best possible approach may be a step-by-step development of such systems in developing countries, completing the following tasks:

- i) To carry out a foot measurement programme, which produces statistics of anthropometric data, characteristic for the population;
- ii) To elaborate a shoe sizing system on the basis of the anthropometric survey, taking into consideration the recommendations made by ISO;
- iii) To establish or adopt a standard for grading of patterns and last construction;
- iv) To elaborate a co-ordination system for components manufactured and/or used for footwear.

Standardization is an efficient economic means for reducing production costs. In order to maintain the systems introduced, well elaborated technical information, manuals and guidelines ought to be issued for all the users and those involved in product development and range building. National and regional product development centres may play a leading role in this activity.

#### 4.5. Training

In case of erecting component manufacturing units, training is even more important than usually. Before and during the implementation period, the following personnel should undergo special training:

- i) Operators, who should be trained to effective working methods (movement sequences), preferably using analytical training techniques;
- ii) Designers, and pattern makers to enable them to utilize as fully as possible, the standardization (co-ordination) system;
- iii) Middle management, to check the realization of the adopted standards.

Besides the preparatory training, periodic re-training should be undertaken.

## 5. CONCLUSIONS AND RECOMMENDATIONS

It is believed that the facts, data, technical informations and arguments presented above, are self-explanatory. The more important conclusions are summarized below:

### 5.1. Conclusions

The following conclusions are felt to be the most significant:

- 5.1.1. The modern leather products industry uses a large number of components, auxiliaries, patterns and tools either supplied from other subsectors or centrally pre-manufactured for different footwear, leathergoods, gloves and leather garment factories. Industrial development in this sector, as observed in developing countries, has generally not made use of such organization and co-ordination of production, which has caused losses and has lead to ineffective utilization of plants erected.
- 5.1.2. Based on lasts and standard systems of grading, a co-ordination of components have been adopted in most of the industrialized countries. These standards make it possible to build components in conformity to construction, even though the components may be produced independently of each other.
- 5.1.3. Some of the components and auxiliaries require special basic materials or sophisticated manufacturing technology; therefore, these will have to be imported into developing countries for the near future.
- 5.1.4. Depending on local conditions, patterns, cutting dies, shoe lasts, woven leather, shoe uppers, insoles, stiffeners, welts, heels and top-pieces, unit soles and a range of fittings may be centrally manufactured in developing countries. By doing so, a significant amount of foreign exchange may be saved. In establishing regional component manufacturing units, the delivery terms and the co-operation among neighbouring developing countries might be improved.
- 5.1.5. Component and auxiliaries manufacturing units may utilise local basic materials (leather, leatherboard, plastics, rubber, metalworks). Furthermore, the manufacture of components may be undertaken in existing production plants and/or with other components or toolmaking workshops, thereby increasing efficiency and economising on space and investments.
- 5.1.6. National and/or regional development centres may assist in elaborating standards for co-ordination of components and training local labour and staff.

## 5.2 Recommendations

- 5.2.1 Developing countries who have substantial leather and leather products industries or plan to strengthen their activities in this sector, ought to pay attention to the possibility of centralized component supply.
- 5.2.2 It is strongly recommended that an examination be made of the possibilities of establishing regional co-operation in manufacture and trade of selected components and auxiliary materials in developing countries. This should be based on local manufacture and exchange of items, which could be pre-fabricated or produced efficiently in these countries.
- 5.2.3 Owing to the differing characteristics of the populations of different countries, it is recommended that well elaborated shoe sizing, consequently last standard and component co-ordination systems, based on foot measurement programmes, be introduced.
- 5.2.4 Since shoe lasts and patterns are the base for both pre-fabrication and product assembly, special attention should be paid to these areas and all efforts should be made for centralized last-making and national/regional co-ordination of grading activities.
- 5.2.5 When deciding on starting local component and/or auxiliaries manufacture, it is suggested that in-depth technoeconomic feasibility studies be undertaken taking into account all the factors, enumerated in section 4.1 of this study.
- 5.2.6. Developing countries or regions with potential to establish component manufacturing units for their footwear and leather products industries should consider the benefits of starting joint ventures or other type of co-operation with component manufacturers in the industrial countries. This would result in the fastest possible "know-how" transfer, both in technology and fashion, and benefit the trading capabilities at both parties.

ANNEX 1

ABBREVIATIONS USED IN THE STUDY

\$ - Dollars of United States of America

Materials

EVA - Ethyle - vinyl - acetate  
PA - poly - amide  
PVC - Polyurethane  
TR - Thermoplastic rubber  
Al - aluminum  
Cu - copper  
Fe - iron  
Zn - zinc

Organizations (and their headquarters)

ISO - International Standard Organization  
(Geneva - Switzerland)  
UNIDO - United Nations Industrial Development Organization  
(Vienna - Austria)

Countries

GDR - German Democratic Republic  
USSR - Union of Soviet Socialist Republic  
UK - United Kingdom of Great Britain and Northern Ireland  
USA - United States of America

Units of Measurement

All units applied in the study are official abbreviations of the International System (SI) authenticated by ISO. The following units are mentioned in the study:

m - meter  
m<sup>2</sup> - square meter  
m<sup>3</sup> - cubic meter  
kg - kilogram  
h - hour  
bar - 100,000 N/m<sup>2</sup>  
N - Newton (= 0.102 kg-force)

ANNEX II  
TERMINOLOGY OF MATERIALS, AUXILIARIES  
AND COMPONENTS USED FOR LEATHER PRODUCTS MANUFACTURE

Basic materials are processed directly from raw materials usually found in the native state (e.g. from wood, oil, ores, animal skins). The most important items used for composite elements of leather products and/or their components are:

- genuine (tanned) leather,
- simulated leathers (coated fabrics, poromerics, foils),
- textiles (fabrics, yarns, threads),
- timbers, board,
- cork,
- rubber (natural and synthetics),
- plastics (EVA, PA, PE, PUR, PVC, TR, etc.)
- metals (mostly Al, Cu, Fe),
- paper or paperboard.

Auxiliary materials are those items used for assembling of components, cleaning and finishing, machine servicing etc. The more frequently used auxiliaries are

- adhesives and hot-melts,
- nails, tacks, staples, rivets, rings, wires, zippers.
- laces, threads, reinforcing and binding tapes,
- needles, awls,
- dyes, pitch, creams, talcum powder,
- inks, dissolvents, chemical agents, fuels, hydraulic oil, lubricants
- wrapping materials, marking/ stamping foils.

Fittings usually made of metals or plastics are used either for connecting components or decorating the leather products. Although many of the auxiliary materials are also used for such purposes, the most characteristic representatives are the following:

- locks, frames, decorations, joints, corners,
- eyelets, rivets, buttons and push-buttons, buckles.

Components are simple (e.g. vamp, bag-side, collars) or premanufactured parts (e.g. unit soles, uppers, pockets, linings) of leather products made ready for assembling or building into the product construction.

Manufacturing tools are frequently used auxiliary equipment for cutting/trimming, perforating, marking/stamping, forming (moulding), pressing, burning, roughing, polishing/buffing, sparing etc. The shoe last is



considered as special kind of tool.

Patterns are (generally plane) detail models of designs to be cut from sheet materials, folded by their edges, or used for checking the preciseness tools or operation performance.

