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LEATHER TECHNOLOGY CENTRE

DP/CPR/83/C04

THE PEOPLE'S REPUBLIC OF CHINA

China.

Technical report: Footwear Technology *

Prepared for the Government of the People's Republic of China
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of F. Mencii
Expert in Shoe Technology

United Nations Industrial Development Organization
Vienna

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I - SUMMARY

The project DP/CPR/83/004 entitled "Leather Technology Center (LTC)" is a follow-up project to the project DP/CPR/80/007 "Assistance to the Establishment of Central Leather Laboratory in Shanghai".

At the request of the Chinese Government, United Nations Development Programme provided funds for the project on a cost-sharing basis. The total project budget of US $ 700.000 has a US $ 250.000 cost-sharing component. The equipment budget line is executed by the Chinese Government.

Part of the equipment funds are used for the purchase of modern shoe machinery which is expected to be used in the Leather Technology Centre for training and demonstration purposes as well as for pilot production. This machinery has, however, not arrived during the subject mission.

The Footwear expert (post 11-05) was fielded to conduct training seminars in modern shoe technology for selected participants, and to give general advice on the modernization of the shoe industry in China.

The one and a half-month mission took place from early October to mid-November 1985 and the expert studied the functions and plans of the Leather Technology Centre (LTC) ; visited several shoe factories, a tannery and a shoe last factory ; he delivered 24 lectures to selected participants and prepared comments on the modernization of the Shanghai Shoe Industry and recommendations for the further running of the project.

II - TERMS OF REFERENCE, ARRANGEMENTS AND ACKNOWLEDGEMENTS

1. Terms of Reference

As specified in the job description DP/CPR/83/004 11-05/31.7.D :

Conduct a training seminar for selected participants covering the following subjects :

- present status of the shoe industry
- development trends in shoe manufacturing technology
- product development
- production techniques
- international marketing
- joint ventures

The expert will also be expected to prepare a technical report setting out the findings of the mission and recommendations to the Government on further action which might be taken (JOB DESCRIPTION ENCLOSED ANNEX III).

2. Arrangements

The expert left Europe as per agreement on 1 October 1985, stayed overnight in Hong Kong and arrived in Shangaï on 3 October.

He left Shanghaï on return journey on 10 November and arrived in Europe on 12 November having stayed overnight in Boston.

The debriefing in Beijing took place by telephone with Mr. Sissingh on whose advice a personal visit to Beijing was cancelled, because neither accommodation nor return could be guaranteed due to enormous tourist traffic and official visits.

3. Acknowledgements

I wish to thank Mr. Shi Xiang Lin, National Project Director and all his staff at the Leather Research Institute for their generous assistance to the work programme and their hospitality and kindness.

III - FINDINGS AND ACTIVITIES

1. Leather Technology Centre, Shanghai (LTC)

The tanning part of the Institute is fully operational, both as far as testing and research is concerned as well as in respect of pilot production.

On the other hand this is not the case with the shoemaking operations.

The shoe machines, which have been ordered by the project have not arrived as yet. There are only two heavy stitching Adler machines for moccasin work; a thermofolding machine, grading machine and a splitting machine all purchased by the Government. None of the machines has ever been used, because they do not know how to. The expert managed to get one of the machines going, however there is no suitable work for it. It should be pointed out, that manuals for those machines are missing and should be replaced.

There is a set of Omic stitchdown machines on order ; suppliers at present are awaiting information as to what last will be required. A decision should be made on this subject during the forthcoming visit of Mr. Shi Xiang Lin in Europe and suitable last models selected and ordered either from Italian or German last makers.

There is further on order a set of cement lasting machines with a heel forming machine from Schoen. A decision on lasts is also needed for these machines so that tooling can be made.

As far as it is understood by the expert these machines are to serve not only as a demonstration of modern shoe technology but also as means of earning money for the Institute to keep it self-supporting (at present they make some shoes by hand for sale).

While it is less important, what kind of equipment is being used for the money-earning activity, it is of great importance that for the purpose of teaching technology the right equipment and material is used. Essence of modern shoe technology lies in automation, special components and speed. Thus provision must be made for the right type of counters, toepuffs and insoles and it is indispensable to use precise plastic lasts and heat setting !

While plastic lasts can be made locally, for the time being the Institute will have to receive a supply of the mentioned components and a heatsetting machine should be ordered.

Obtaining suitable technologists to operate the pilot production should be given priority. They need not to be great scientists but rather practical men with experience in running a modern shoemaking workshop, preferably having started their professional life as foremen (thus capable of operating and demonstrating machines).

Some attention should be devoted to the shoe testing function of the Institute and in particular adhesion testing, which leaves much to be desired.

First of all to test adhesion of soles once a month is insufficient, apart from the fact, that should the test show insufficient adhesion, by that time already thousands potentially faulty pairs have been delivered. Also, to express the adhesion for a pair of shoes as average of the result of both half pairs can be described only as misleading. In reality the adhesion testing should be done daily on factory level with a simple gadget (like Satra) and supervised and counterchecked occasionally by the Institute. Also the minimum adhesion standards seem to be arbitrarily set and not sufficiently rigorous. The expert left with the National Director a list of correct minimum adhesion requirements as considered standard in Europe.

The above activity and the following very important task will require a higher grade of man with laboratory and shoe and last engineering experience.

On the eve of introduction of modern technology into the shoe factories, which at present use hand-shoemaking and primitive wooden lasts, the correct foundation must be laid for the future : The correct measurements for the lasts for domestic production must be ascertained (probably by extensive foot measurement operation) the width and sizes codified and a back part standardisation for various types of heel heights established. This would save much expense and unnecessary complications in the future.

There are other important tasks to be accomplished during the introduction of modern technology, such as specifications for various materials and components, thicknesses (including upper parts) thread, needles, number of stitches etc.

Fortunately one can draw here on the specifications and standards in existence in the West and the expert left a set of such "minimum quality specifications" with the National Project Director.

2. Visits to Factories

A number of shoe factories in Shanghai, Hangshau and Kiangsu Province and one tannery in Shanghai were visited.(ANNEX II).

This was very valuable and enabled the expert to understand the various problems. Essentially the technology is very simple and labour intensive. While here and there some machines are being used, for example for cutting of materials and very few lasting machines, this is done only for shoes destined for domestic market and shoes for export are made very elaborately by hand. Due to the skill of the workers the resulting shoe for export is fairly good, the main faults being the excessive use of cement in upper making and heavy counters with the same excess of cement.

Shoes for the local market are made generally from very hard upper material and using often inferior components, for example wooden heels on ladies shoes with top lifts made of insufficiently resistant material. Visit to street shoe repairers indicated this to be the most frequent cause of failure. In addition, sole adhesion causes problems in wear.

The performance - output per man per day is between 2 1/2 - 3 1/2 pairs compared to a western standard of about 20.

In addition, and partly as a result of the hand shoemaking and partly due to use of excessive cement in the uppers, counters and, of course. absence of heatsetting, the production cycle is in excess of 3 weeks from cutting to the box and requires about 3 000 pairs of lasts for a daily output of 1000 pairs which in the west would be done with about 300.

Both of these aspects mean enormous use of capital for "goods in production" that is ten times the cost of uppers and lasts than in Europe.

While the cost of wages is so low, that even the great number of operators and employees leaves China still competitive in export markets; this situation is going to change with the improving standard of living and increasing wages and the problem must be dealt with in time.

Suggestions for improvements of present quality :

1 - Obviously great effort is needed to improve the quality of leather.

2 - Sewing needles and thread require attention. At the moment exclusively needles with round point are being used which are suitable only for textile while needles with various cutting points should be used for leather. This will become even more important when faster sewing machines are going to be introduced.

3 - Thread used is mostly synthetic for the bottom thread and silk for upper thread even for joints where strong resistant seam is required (backs, vamps, etc...).

The expert left standard descriptions for needles, thread and number of stitches per 1 cm with the National Project Director to help introduce improvement.

4 - The expert recommends to start using mulling of uppers before lasting, particularly of the hard leather uppers on hydraulic machines.

5 - Roughing should be improved. In many cases it does not remove the grain layer so that the cement does not penetrate into the fibres.

Daily testing of adhesion in every factory with a simple device like Satra's should be done. (Details of required adhesion for Satra tester were left with the National Project Director.)

3. Lectures and Seminars

In accordance with the job specification the expert delivered lectures to an audience consisting of technical managerial personnel and designers in the Technical Research Institute.

The group consisted of about 70 people and there were 24 lectures which took place in the morning.

The list of subjects covered most of the technological and marketing subjects selected by the National Project Director from a more voluminous list prepared by Mr. F. Schmel, (DP/CPR/83/004/11-05).

List of those lectures is enclosed (ANNEX I).

One of the problems was translation but fortunately the expert brought a number of visual aids :

13 Video casettes on a range of subjects

8 Sets of slide presentation totalling some 40 slides

9 Sets of transparencies showing in great detail technical and marketing subjects

Further a great number of machinery catalogues, samples, lasts and components.

All those were left with the National Project Director for further use and some of them were being shown to other classes before the expert departed.

The lectures were delivered for two hours every morning and in the afternoon a seminar was held with a selected group from the audience - about 20 people in which questions were answered and explanations given, making sure that any possible misunderstanding was eliminated.

In this group the interest was very lively and the expert had opportunity to get answers to questions arising from his factory visit.

Seeing that the State-owned factories do not carry out any marketing and particularly not in export markets, the expert delivered slide presentations, including one about trends in marketing and shoe fashion, to a group of executives of the Foreign Trade Corporation.

The expert also gave a morning's lecture on the present state of art in shoe manufacturing to a group of local shoe technicians during his visit in Hangshau.

4. Comments on modernization of Shanghai shoe industry

In a way, it can be considered of advantage to start practically from the beginning.

First of all it is necessary to start methodically and avoid haphazard steps taken at random in the desire to make quick progress.

A master plan should be established for the whole of Shanghai shoe factories.

It should start with the definition of the goal - i.e. total capacity, size of individual units, their specialization :

a) according to type of footwear to be produced (construction),

b) quality (it being most difficult to try to produce inexpensive and high quality in the same factory),

c) market destination (domestic, export, what country).

Next should be the foundation, namely, lasts (already mentioned earlier) and the rest of the infrastructure necessary for a healthy shoe industry, such as production of suitable insole, toepuff and counter material and, of course, hand in hand with that the continuous improvement of upper and sole leather and other soling material (for example, the rubber soling material is produced in small-size sheets about 30 x 30 cm instead of 100 x 100, which results in waste of material of at least extra 15 % plus labour - to economize on machines, in this case hydraulic vulcanizing presses is a shortsighted policy).

As far as machinery and equipment are concerned, after careful examination the types and models most suitable should be identified and agreed upon and then only those machines ordered for every factory. Again it is suggested that the best and most efficient machines should be selected which are not necessarily the cheapest.(This suggestion is based on the expert's observation that in three factories hydraulic lasting machines of different make were installed, which means waste in investment in spare parts and inefficient maintenance).

One should not neglect sewing machines, the fact that one simple and very slow machine is made locally should not block introduction of modern sewing technology.

Finally, the training of technicians should start intensively and with all speed. One must count with at least 2 years of overseas training part of which must be on-the-job training. It is considered that if the selection and concentration on a few makes of machines is carried out, the machine manufacturers will facilitate such training apart from the advantages of price discounts, service etc. During the expert's stay he met number of people who would be very suitable for such assignment.

IV - RECOMMENDATIONS

A. To the Leather Technology Centre

The Leather Technology Centre should order manuals and sparepart lists for the existing shoe machinery.

Suitable shoe lasts should be decided upon and sample lasts and last bottom (insole) models should be sent to the suppliers of the Veldtschoen equipment (Omic) and for the cement lasting equipment (Schoen) for the manufacture of tools. The main criteria for last selection should be the following : suitability for pilot production ; component availability ; good fit for the intended market, suitability for the intended process.

Components and auxiliaries for the pilot production should be ordered.

Heat setting machine should be ordered.

A training programme should be elaborated for the project personnel in the shoe technology.

B. To the Shanghai Shoe Industry

1. A master plan should be developed for the modernization of the industry. This masterplan should have the following components :

   - Specialization of the various factories to different product groups, and for various market destinations. Such specialization would assist enormously in selecting the right type of machinery, training of employees on right level and selecting correct materials and components for each product group, and thereby improving productivity and quality.

   - Improvement programme should be started for all shoe materials including leather, various components and auxiliaries.

   - Improvement programme for the shoe last manufacturing. This programme should start with a foot measurement programme for the local market and collecting data for the various export markets. The last's backpart should be standardized on various heel heights, so that standard components can be used to greatest possible extent.

- Training programme should be prepared for shoe technologist, designer, pattern maker, shoe machinery engineer and skilled worker training. It is important that individual programmes on correct levels will be elaborated including all practical subjects. The skilled workers who are to be trained on mass-produced standard shoes have to receive different type of training than those who are to be trained for high quality fashion shoes.

2. During the visits to the various shoe factories it was noted that some immediate technical improvements would be urgently needed. The most important are :

- Improvement in roughing. The whole lasting margin must be properly roughed and the grain layer of the upper removed to facilitate good sole bond.

- The sole bond should be tested on continuous basis. For such testing a simple sole adhesion tester should be used (SATRA STD 185).

- Mulling of the shoe uppers prior lasting should be introduced. This is especially important for the stiff leathers used for local shoe production.

- Various types of sewing machine needles with leather points such as "Twist" and "Wedge" should be introduced instead of the presently used round point needle; at the same time correct sewing threads and the correct stitch lengths should be introduced and controlled. The expert has left with the National Project Director such tables.

- For hand cutting of upper leather special knives should be used. This is more efficient than using scissors and more accurate. However some training period is needed to acquire the necessary skill.

- Improve upper making, specially by reduction of cementing. Introduce laminating of lining by latex, using spraying gun and press for laminating.

ANNEX I

LIST OF LECTURES

1 - Shoemaking history and technological development.

2 - Last - measuring, sizing systems, standardization, manufacturing of lasts. Plastic lasts.

3 - Materials used in shoemaking, types of hides and skins and th. uses. Soling materials. Synthetics.

4 - Designing. Copy of last techniques. Pattern developing. Allowances for stitching and lasting.

5 - Cutting of materials. Leather and correct manipulation. Cutting of linings, synthetics, textiles.

6 - Cutting machine development, sewing arm cutting machines, bridge cutting machines. Revolver cutting heads, microprocessor with programme storage.

7 - Cutting dies. Development. Cold steel knives, double edge steel stripes, size marking.

8 - Upper sewing. Types of sewing machines. Mechanical automats. Types of needles, points and shafts. Threads. Sewing machine attachments and guides. Instant stop and go machines. Types of feed. Automatic thread cutting. Computer assisted stitching, Palet technology.

9 - Other machines in sewing workshop. Marking, skiving, thermofolding, laminating.

10 - Lasting, concept, development from hand lasting. Present technology, hydraulic two machine lasting with hotmelt injection. Computer assisted machines.

11 - Other types of lasting-Californias, Good year welts, Slip lasting, string lasting.

12 - Preliminaries to lasting - box toe applying, counter insertion, back part moulding, use of thermoplastic and dipping materials, mulling.

13 - Heatsetting. Its importance. Variety of methods and machines

14 - Cemented shoe workshop. Workshop layout and operations. Roughing methods and machines. Cements, Neoprene and polyurethane one and two component cements. Activation. Halogenation. Adhesion testing.

15 - Californias. Workshop layout, construction. Slip lasting and lasting of cover.

16 - Stitchdowns. Technical concept, lasting. Sole attaching workshop layout.

17 - Costing. Costing of material, consumption. Small materials. Wage calculations. Overhead direct and indirect. Distribution costs-various methods. Profit.

18 - Preparatory stages. Range building, styling, sources of informations. Grading of patterns. Costing. Market best and finalisation. Time-tables.

19 - Production. Production planning. Production prescribing. Cyclus. Material management. Production management.

20 - Quality. Material specification and control. Minimum quality specifications. Tools for control and reference samples. Control during various stages of production.

21 - Markets of the world, characteristics. Import and export countries. Statistics and trends.

22 - Western marketing. Fashion trends. Consumer types. Promotion and advertising. Shoe shows. Magazines. Independent designers, pullovers etc. Brands importance.

23 - Principal exporters and their success stories. Channels of export to USA. Elements to consider when selecting types of goods and articles. Pricing.

24 - Training, technical schools and colleges. Training of operators. Training on the job. Training of foremen, designers and managers.

ANNEX II

LIST OF FACTORIES VISITED

Shanghai Shoe Factory

Produces some 5 million pairs p.a. plus 3.600.000 pairs of gloves including all branch factories with approx. 1500 people.

Shanghai No 1 Shoe factory

Produces 1,300.000 pairs p.a. with 1800 people.

Shanghai No 2 Shoe factory, mainly men's shoes, 2.3 million pairs p.a. with 1200 people.

Shanghai No 3 Shoe factory (the World shoe factory), produces approx. 3,600.000 pairs p.a. 900 people.

Baon Ji Shoe factory No 7 - 1000 people, 3.5 pairs per head per day, mainly ladies shoes, considered to be very good.

Shanghai Ya-Zhou Shoe factory, output 1600 - 1800 prs per day

Hanchow Shoe factory, 900 people, 750.000 pairs p.a., all for local market.

No 2 Wujian shoe factory - 1400 people, 1 million prs annual output. Produces only for the domestic market.

Yi Ming Tannery. Soaks 600 bovine hides for uppers and 1000 pig skins per day. Experimental production of counter and toe puff material.

Shanghai shoe last factory
Produces 600.000 prs of wooden and plastic lasts
Equipped with uptodate Japanese machines, including.

ANNEX III

PROJECT IN THE PEOPLE'S REPUBLIC OF CHINA

JOB DESCRIPTION

DP/CPR/83/004/11-05/31.7.D

Post title	Footwear Expert
Duration	One and a half months
Date required	October 1985
Duty station	Shanghai, with travel within the country
Purpose of project	To complete the establishment of a well-functioning Leather Technology Centre including a unit for designing and styling footwear as well as improving the quality or components and accessories used in various kinds of footwear.
Duties	The expert will be attached to the Ministry of Light Industry through the Shanghai Leather Corporation and will work in close co-operation with the National Project Director. The expert will specifically be expected to :

- conduct a training seminar for selected participants covering the following subjects :
  - . present status of the shoe industry
  - . development trends in shoe manufacturing technology
  - . product development
  - . international marketing
  - . joint ventures

The expert will also be expected to prepare a technical report setting out the findings of the mission and recommendations to the Government on further action which might be taken.

Qualification	A senior footwear industry expert with a thorough knowledge of the footwear market in the industrialized countries and considerable experience in the production of various types of footwear.
Language	English
Background information	The country has fairly rich resources of hides and skins and a long history in the development of the leather industry. The production of raw hides is estimated at five million pieces of bovine hides, in addition to 30 million goat and kid skins. The production of sheepskins is somewhat lower than that of goat skins and most of these are processed by the fur industry. A small quantity of cattle hides and wetblues, processed only in tanneries on the coast, are imported to satisfy the needs of tanneries. The production of pigskins reached 49.8 million pieces in 1979 thus providing a large resource for the leather industry. To promote the production of pigskin, modern skinning techniques and machines are required and tanning technology needs to be improved, while special leather products made out of pigsking need to be developed. The country's leather industry consists of 40 - 50 important tanneries. The main leather manufacturing centres are in Beijing, Tienjin, Canton, Szechuan and, the most important one, in Shanghai. The tanning of soft leather, mostly by chrome, is acceptable but the dyeing and finishing process should be improved. Vegetable tanning is used for processing leather for soles and technical purposes. The splits produced are of rather poor quality. Key operations of the leather processing, such as sammying, splitting, shaving and especially dyeing and finishing processes require considerable improvement involving increased inputs of production machines, chemicals, know-how, improved production flow, layout, process control and higher skills of operators and supervisors. In the country's shoe industry, manual processes are still prevalent. Total annual footwear production is estimated at 750 million pairs, some 200 million pairs (26.7 %) of which are made out of leather. The shoe export amounts to approximately 15 million pairs but manufacturers are experiencing major problems due to the rather poor design of their products. Mechanization of shoe manufacturing is now of great interest - with special reference to closing and making rooms - and cannot be accomplished without the introduction of new working methods, technologies and production control techniques.

The leather, footwear and leather goods industries lack modern technical know-how and adequately trained personnel, especially in management, technology and product development. Technical information supply, training and retraining of specialists from industrial plants, i.e. transfer of up-to-date know-how, would be of great assistance to the national leather and leather products industry, enabling it to meet local demands as well as the requirements of the national economy.

The establishment of the Shanghai Leather Laboratory was a step towards the above-mentioned long-term objective of the country's leather subsector development. At the request of the Government, UNDP provided funds under project DP/CPR/80/007 to assist in the start-up of the Laboratory. As a result UNIDO fielded the Chief Technical Adviser in May 1981 for six weeks to Shanghai and, according to his recommendations, the equipment was delivered for the testing laboratory. The Laboratory was established and commenced operations in April 1982, constituting the initial framework for the planned Leather Technology Centre. (The latter is understood to be a follow-up or expansion programme of the Shanghai Leather Corporation).

In order to facilitate the implementation of the Leather Technology Centre Project, the Government has decided to provide a newly constructed six-storied building to house the Centre with the laboratories and the pilot plants for footwear and leather goods.

The Government, apart from meeting increasing local demands, is striving towards an expansion of the export of different leather products. However, in order to realize this objective, several aspects of the leather industry sector have to be greatly improved, such as processing technologies, production methods, design and product development techniques. Furthermore, personnel skills at different levels, and trade and export marketing practices need to be up-graded.

An essential prerequisite for the country's leather industry subsector to be able to develop reasonably rapidly is the extension and development of the Shanghai Leather Laboratory into a Leather Technology Centre, suitably staffed and with well-equipped laboratories, pilot plants and information of training courses and extension services to existing tanneries and leather product factories, thereby achieving the improvements required.