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STRENGTHENING OF THE CHINA DYEING AND FINISHING DEVELOPMENT CENTRE

DP/CPR/87/017/11-06

CHINA

Technical report: Assistance to the China Dyeing and Finishing Development Centre*

Prepared for 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 Jan A. Jongbloet,
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* This document has not been edited.

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ABSTRACT

Strengthening of the China Dyeing and Finishing Development Centre. Project DG/CPR/87/017/11-06.

Technical Report - Visit of Expert in Textile Finishing and Fabric Coating, July - August 1990.

The report details the activities of the expert in textile finishing and fabric coating with the China Dyeing and Finishing Development Centre, (CDFDC), July 9-29.

Visits were made to three Shanghai Dyeing and Printing Mills; each visit was of one day's duration and took the form of an introduction to the activities, tour of the factory, and an extensive exchange and information round on finishing, but mainly polyurethane coating techniques and fabrics.

A three day formal lecture cycle with discussion periods covered a range of technical topics requested by CDFDC.

The utilisation of the laboratory coating machine and the pilot plant coating machine in developing transfer coated products for apparel, decoration and technical outlets was implemented.

The future role of CDFDC in the development of the textile finishing and fabric coating industry of the People's Republic of China (PR) was reviewed and discussed in depth.

Suitable steps for the further development and tasks by CDFDC were proposed. A tentative proposal for structuring the servicing to the China dyeing, printing, finishing and coating textile industry was formulated.

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INTRODUCTION

As a contribution to the UNIDO project - The strenghtening of the China Dyeing and Finishing Development Centre - a visit of three weeks duration was made to Shanghai in July 1990 by Mr. J. JONGBLOET as expert in textile finishing and polyurethane coating of fabrics.

The duties of the expert as set out in the job description were :

- to demonstrate the utilisation of laboratory and pilot plant finishing and coating machines in developing new projects for apparel, decoration and technical outlets.
- conduct a seminar on the latest technology and machinery for the production of coated fabrics.
- give technical advice on research work to be pursued in this field.
- to give an extensive series of five lectures on textile finishing and polyurethane coating of fabrics.

The performance of these duties is reported under heading I. ACTIVITIES.

Because the basic practical knowledge of polyurethane coating is not yet fully acquired, it has been suggested to start a programme of comparative studies regarding the polyurethane compounds and release papers of different manufacturers. How to do that was amply demonstrated.
It was confirmed at the end of my stay that the real purpose of requesting my visit was to get into production the new industrial size coating line, installed in the pilot plant. That was done during the last week of my stay.

RECOMMENDATIONS

1. It is obvious that the future financing of the work of CDFDC will be based on the net revenues of the sale of coated fabrics, produced by the industrial machinery installed at the pilot plant.

2. An open minded and realistic discussion should take place about the future financing of the CDFDC. That financing should be based on an organisational structure securing :
   - basic research programs
   - applied research programs
   - stand-by assistance
   - technological advice
   - specialized services
   - technical education and formation

   The net income of the sale of coated fabrics should be allocated in order to have a clear situation and budgetting possibility.

3. After finalising some mechanical adjustments and balancing out the capacity and efficiency of the drying sections by regulating exhaust rates, the development and production of standard coated fabrics can start.

4. Therefore, the pilot plant must be provided with full-scale standard solving, mixing and filtering equipment for the preparation of polyurethane compounds. The necessary auxiliary equipment such as a release paper inspection machine, a coated fabrics inspection machine, racks for stocking rolls of cloth, and racks for rolls of new and used release paper must be provided for. According to informal information some of those machines are already ordered and will be delivered shortly.

5. A full-width one roller printing, lackering and siliconising unit is indispensable to complete the whole range of finishes on coated cloth.

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6. The necessary laboratory equipment should be provided for and concentrated in the laboratory of the pilotplant in order to enable full control of samples run on the laboratory coating machine and to control the essential parameters of coated fabrics run on the coating machine. In the first place we think of modern hydrostatic head testing equipment and a quick weighing apparatus.

7. Eventually airconditioning must be installed in the laboratory to execute testing according to ISO or equivalent norms. Also airconditioning must be provided for during summer in the building of the industrial coating machine in order to exclude a continuous deposit of dust on the releasepaper and to avoid changes in the viscosity of the compounds during coating.

8. Adequate provision should be made by CDFDC for the acquisition and storage of sample quantities of a representative range of polyurethane compounds and transfer paper qualities from traditional suppliers worldwide, so that development is not limited or frustrated by the sole criterium of price.

9. CDFDC should organise some coating seminars for the Chinese Textile Industry once the industrial coating machine can be fully and easily demonstrated.

I. ACTIVITIES

A. Visits to factories in the Shanghai area.

Factories visited were :

Shanghai No. 2 Dyeing and Printing Mill.

Shanghai No. 2 Printing and Dyeing Silk Factory.

Yong XIN Raincoat Dyeing and Weaving Works.

Each visit consisted of
- a presentation of the works.
- a more or less complete visit to the works.
- a two or three hour presentation of the sample range of the N.V. Vetex, demonstrating - direct coating techniques
  - transfer coating techniques
  - laminating techniques
  - latest technical developments

Although coating machines were available, nowhere a coating machine was seen in operation.

Specifics of the three visits.

Shanghai No. 2 Dyeing and Printing Mill.

- works only at 60% of capacity - due to broken down and outdated, idle machinery. In short : apart from some exceptions of more recent Western European Machinery (see Annex 2) - the methods and machinery used should be moved straight away to a Textile Antiques Museum. Access to the machines was very difficult; transport facilities were awful; lighting conditions were medieval.

- a fairly recently constructed building was being completely overhauled to install a new 10 colour screen roller printing machine of Stork (the Netherlands) construction.

Coating

- somehow management had been told coating would be possible with screen-roller application and therefore wanted to hear about coating of polyurethanes.

- the staff was surprised to hear solvent based systems were excluded with that system; only applications of dispersions of polyurethanes or polyacrylates would be feasable.

- management had no idea what kind of articles it would make or coat.

- a very big interest was displayed in the whole range of samples presented.

Flameproofing

About 50.000 m of material a day was flameproofed, consisting of different qualities according to intended use : protective clothing, tenting, upholstery fabrics, a.s.o.
In China a regulation seems te be in existence that all textiles present in buildings higher than ten stories, must be permanently flameproof.

The flameproofing agents were of local origin, but after discussion, appeared to be equivalent to the Pyrovatex PC from CIBA, and produced by a sort of joint venture for local consumption. The additives, curing agents, a.s.o. seemed to be supplied directly from CIBA. For some articles a combined stainfree and flameproof finish was applied. Formulations and results for the 100% cottons were comparable with those of our mill, and were also adequate.

On the contrary, some problems were encountered with polyester/cotton blends - and 100% polyester cloths.
Information was given on the basis of the product range of Allbright & Wilson (England) and its formulations, of which they took notice.

Water and steam consumption

Attention was drawn on the excessive waste of water and steam : the consumption of water is three times higher than that of a modern, well managed mill. It was said that savings in water and steam result in :

1. savings of heat energy.
2. savings of electrical energy (pumps, motors, etc.).
3. savings of products and additives.
4. savings of waste water treatment costs.
5. savings of natural resources.
6. savings of new investments.

and others.

Shanghai No. 2 Printing and Dyeing Silk Factory.

Some good, very light polyamide fabrics, coated with polyacrylates were shown. Also a 100% polyester cloth coated with a polyacrylate basecoat and a polyurethane topcoat was shown.

The direct coating machine seemed to be regularly used, to judge from the persistent smell of solvents, which was certainly exceeding allowed levels.

A textile baton, still te be coated, was introduced in the inlet of the machine; a couple of empty containers were leaking out upside down, but no coating was going to take place.

The inspection of the transfercoating machine (Cotexma - Germany) - let me to conclude that it had not worked for several years - although the specific mechanical features for production seemed to be available on the machine.
Extensive explanation on manufacturing details was provided on the basis of the very varied sample range of our firm
Formulations were given for specific direct polyurethane-coated fabrics.
The technical staff was not aware of the possibilities of polyurethane-printing, lackering and siliconising of coated fabrics.

YONG XIN Raincoat Dyeing and Weaving Works.

- A direct coating of polyacrylate dispersion was applied on light polyester-cotton fabrics.
  Production was not mentioned. The coating machine was not operating.

- Two laminated articles were shown : as adhesive a polyacrylate dispersion was used
  - two dyed polyester-cotton fabrics of different colour - laminated together - after one cloth was directly coated by means of an air-knife
  - idem, but polyester liner laminated to topcloth

- Also a direct coated cotton-polyester blend to be used for protective clothing was presented.

- Further a quality for light obstructing curtains was shown, one side foamcoated with polyacrylate.
  Two versions were presented : one non flame-resistant, and one with a permanent flame-resistant finish.
  Samples were submitted for testing at our plant.

- The main part of the exchange consisted of explaining and providing full information upon :
  - our range of the direct coated polyurethane-samples, for which a very keen interest was shown
  - and secondly as a possibility, our transfercoated samples - in all their variety.

- A future economic outlook for coated articles in general was asked for. Personal views on development areas and future possibilities were given.

- Also a complete price calculation for a direct polyurethane-coated 100% cotton fabric was documented.

- The use and application of seam sealing tapes for rainwear was illustrated.

B. Seminar

A three day seminar consisting of lectures and discussion periods was held for which the following subjects had been requested by the National Project Director :

1. New trends in finishing of cotton, polyester, silk and acrylic woven and knitted fabrics.

2. Flame retardant finishes for cotton, polyester and cotton/polyester fabrics.

3. Special coating techniques with particular reference to transfer coating and laminating for cotton, polyester and other synthetic fibre fabrics.

4. Waterrepellent, hydrophilic, watervapourpermeable finishes for cotton and polyester-cotton blend fabrics (coating and laminating techniques).

5. Hygienic finishes on polyamide, cotton, polyester and polyurethane fibre fabrics.

All the above subjects were covered by an extensive lecture with technical details and illustrated with many samples, transparancies and formulations. Each lecture was followed by a question and answer period, most of the times in small groups afterwards.
All the samples of coated material and also our own polyurethane-coating range have been left with the CDFDC.
A copy of the lectures was provided in advance to CDFDC and a copy is available for UNIDO if required.

The lectures were given in the entertainment hall of the Shanghai Dyeing and Printing Mill No. 5.

C. Experimental

Laboratory Coating Machine

During several days sample formulations were run on the laboratory coating machine.

The laboratory coating machine is of local manufacture, and is very good of concept. It consists of small detachable units of uniform composition, that are assembled in a logical order. All necessary parts are present. Even a supplementary head for foam coating or foam application and also a polyurethane-printing facility is present. Only the laminating facility is rather of a less precise nature. That means laminating pressure can be fairly well regulated for each run, but the position is not 100% repeatable for the next run. After some experience a reasonable estimation is however possible. The electrical heating zone between the two coating heads might even give the possibility to do a complete transfer coating in one single run, instead of the actual necessary two or three phases.

The drying section consists of two superposed drying sections of 4 m heating content. Each zone is temperature controlled. Due to heat transition from one zone to the other, the air inlet and exhaust arrangements,it is not possible to reach a temperature difference between the two zones of more than 30° C. Due to the evaporation speed of solvents at lower temperatures, a third passage through the drying ovens is necessary. That could easily be fitted in. Heating up the ovens quickly to 130° and 160° C respectively permits a complete dry-off and condensation of the polyurethane compounds by switching the machine in back gear after having dryed off the tie-coat of the laminate at lower temperature.

The laboratory machine suffices amply for doing the preleminary work for developing new coated qualities, and test out the compounds of different suppliers.

The first exercise was to train and discipline the technicians in :

- drawing up a specification of the cloth to be coated, specifics of the cloth, preceding dyeing and finishing procedures of the cloth.
- drawing up a specification of the parameters of the sample run :
  - defining knife gaps
  - speed of coating
  - temperatures of drying sections
  - laminating pressure to the cloth
  - a.s.o.
- actual setting to execute run.
- controlling parameters during run.
- taking the necessary intermediate samples to control data.
- after ending the sample run measuring the results and eventually making corrections on preset specification.
- drawing conclusions for next run to improve result.

Second exercise was to indicate the necessity of absolute cleanliness of the essential parts of the machine.

Actual sample runs :
During our laboratory-testing, we refined the coating parameters for two qualities : a 100% viscose and a one-side raised 50/50 cotton/polyacryl cloth. A Goodrich formulation based on Estane-compounds was available.
However, the matching combination of top- and tie coat for a specific application was not available. So a compromise had to be made. A topcoat indicated for upholstery application and a tiecoat indicated for a clothing quality were combined.

- 100% viscose cloth of 125 gr/m2 : we gradually increased speed and lowered drying temperatures to emulate industrial running conditions.
  The last trial was very satisfactory.
  The base cloth however is somewhat too tight, not so much by the cloth density, but by a too heavy yarn count. Instead of a Nm 30, a Nm 50 should be used in warp and weft, resulting in a standard cloth available both in the People's Republic of China and the international market.
  The weight of such a cloth is 90 gr/m2 instead of 125 gr/m2.
  The importance of a light resinfinish applied before the coating was underlined and explained.

- 50/50% cotton-polyacryl cloth : 140 gr/m2

Based on foregoing trials, a very good coating result was obtained, with a similar approach. The proportion of top- and adhesive coating weight was adapted by modifying the knife-on-roller gaps.

Here again, the importance of the base cloth was underlined. In this particular case a heavier low torsion yarn and a more open structure of the cloth is indicated. Also the cloth should be slightly raised on the back and a preshrinkage is indicated to avoid residual shrinkage during after-washing of the garments.

Due to the lack of pu-compounds of other chemical firms, no comparative coatings could be undertaken. Also, only one kind of transferpaper was available, in this case from Wiggins C°. As mentioned above the combination of top- and tiecoat was not ideal.

Full width industrial coating machine.

During the last week of my stay, assistance has been given at final stages of the erection of the industrial polyurethane-coating machine. Testing out the different parts and learning how to control and set the machine for industrial runs was demonstrated and learned.

The laboratory trials formed a secure base for transfering the settings to the pilot plant machine, the more because the same compounds were industrially available.

After some days of mechanical testing, the final two short runs gave a very satisfactory result.

We report the data of the two last trials : same compound formulation as in the laboratory trials - base cloth : 145 gr/m2 cotton-polyacryl 50/50 blend.
Transferpaper : flat-paper from Wiggins Co.

1st trial	setting	actually reached
speed : 5 m/min		
topcoat : gap: .15 mm		
temp. of ovensections	50-70-90°C	55-75-85° C
viscosity : 12000 cp		
tiecoat : gap: .20 mm		
temp. of ovensections	50-70-120-160° C	55-107-134-150° C
viscosity : 5600 cp		
lamination : three pressures successively applied during run	: light pressure : middle pressure : heavy pressure : best result	

Result : top : 32 gr/m2
tie : 50 gr/m2
total : 82 gr/m2

2nd trial	setting	actually required
speed : 7 m/min.		
topcoat : gap: .15 mm		
temp. of ovensections	55-75-95° C	78-87-109° C
viscosity : 12000 cp		
tiecoat : gap: .20 mm		
temp. of ovensections	55-80-130-170° C	65-105-123-151° C
viscosity : 5600 cp		
lamination : two pressures successively applied during run- middle pressure : slightly ondulating surface - heavy pressure : surface adequate		

Result : topcoat : 37 gr/m2
tiecoat : 50 gr/m2
87 gr/m2

The topcoat, having too much blocking tendency, an antiblocking agent must be added to the topcoat, or a more adequate release paper should be used. If the gloss is judged too high, a matting agent must be added to the topcoat, or a matter release paper should be used.

OBSERVATIONS :

- the general outlay and composition of the machine is all right.
- electrical functioning was satisfactory.
- mechanical functioning is all right
  (some changes still to be executed, have been indicated)
- temperature regulation of the drying sections did not seem under control. We had to cope with leaking oil valves
- Exhaust balance of ovensections : could not be controlled by lack of controlling apparatus. This should be done in order to check the drying capacity and air-balance of each section, and to determine the optimal set of exhaust-regulating positions. The fifth drying section of second oven was not functioning. Several temperature indicators were not functioning. The oil flow must be adapted and regulated for each section.
- an improved laminating arrangement has been suggested.
- the machine is not painted yet.
- the high temperature of the summer season and the radiation heat of the coating machine made cooling off by ventilators a necessity. Also all windows were opened. That caused an enormous problem of dust, soiling the release paper in the machine.
  Airconditioning has been suggested in order to keep room temperature more or less constant during the hot season.

EVALUATION :

With the necessary adaptions and verifications good quality polyurethane coated fabrics can be produced.

However, the elementary auxiliary equipment fails, as :

- a releasepaper inspecting machine : under construction, but in initial phase.

- a rack to hold rolls of releasepaper should be constructed or provided for. Dimensioning depends on supply-conditions of releasepaper.

- a rack to hold rolls of cloth to be coated should be constructed.

- an inspection machine for coated material should be acquired. It was said to be already ordered.

- if industrial production is intended, a perfect roll- and packing machine must be provided for. Tensionless inspecting and packing of pieces is required.

- cloth batching facilities must be present.

- a factory lift truck is necessary.

- a one-roller type printing, lackering and siliconising unit will be necessary in time.

II. CONCLUSIONS

A. Introduction

Informal discussions were held with Mr. Cai Zhong Fang, vice-director of CDFDC on the future role of CDFDC with respect to the development of transfer coating of polyurethanes onto fabrics for the textile industry of the People's Republic of China.

The role of CDFDC in the development of transfer coating of polyurethanes onto fabrics is foreseen by the management to consist mainly of following functions :

- to master the particular aspects of polyurethane transfer coating from different poinst of view :
  - chemical aspects
  - physical aspects
  - technological aspects

- to demonstrate the possibilities in a practical way to interested chinese parties in order to :
  - restart or complement the direct and two-phase transfer coating facilities, existing in some companies.
  - promote investment in transfer coating capacity.

- to provide for training periods for mechanical engineers and chemists of the textile industry.

- in a later stadium to develop new types of coated and/or laminated products for technical applications.

- to engage eventually in the laminating of membranes onto textile fabrics.

It is to be expected that CDFDC activities on behalf of the textile dyeing, printing and finishing industry will require financial support in perpetuity, either by direct government subsidy or by a levy on the industry, probably by a combination of both. This is a common problem for any Research Institute all over the world.
It's the intention of CDFDC to develop as fast as possible an industrial transfer coating activity, the revenue of which must serve as a possible source of finance for the daily expenses and future investments of CDFDC. It's important that this endeavournment is recognised and clearly accepted by all concerned in order to guarantee the further development of activities of the CDFDC.
During his long stay in 1989 at the Shirley Research Insitute in Great-Britain, Mr. Cai Zhong Fang adopted the concept of combining industrial activities with development and research activities. That concept has some very valid arguments to plead for in the chinese context.

B. Pilot Plant

The construction of access-ways to and circulation inside the facility is still in full swing. The dyeing and finishing machinery is not yet installed. Some new up-to-date dyeing equipment just arrived from Denmark (Henriksen).
The framework of a locally made hotflue of huge dimensions was being erected. Fairly recent types of dyeing machines for knitwear were already put up, however not fitted yet with electricity, heat, hot and cold water supply, a.s.o.
Also some ancillary equipment was stacked and positioned in the pilot plant, e.g. : drying drums,raising machines, and scouring and rinsing "skeletons". The corrosion of those frames by the high relative humidity was disgusting. The factory floor was not yet finished, except in the area of the coating machine.

It was evident that all efforts had gone into the readying of the bigscale-production machine for polyurethane transfer coating of fabrics. The coal-fired steamplant seemed to be installed. The coal-fired oil-heating facility was installed and was being readied to function during the last week of my stay. A tremendous effort was made to get the full width coating machine ready for the first industrial trials during my visit. Dozens of mechanics have worked around the clock to get the machine ready. Mr. Cai Zhong Fang and Mr. Wang Chang Cnun even slept at the plant in order to better supervise the work. When I visited the pilot plant at the beginning of my stay, I was convinced the erecting could not be reasonably finished in such a way that all the imperfections and adaptations, needed for successful trial runs, were smoothed out. At the end, I proved to be partially wrong.
During informal discussions, it was obvious to me CDFDC wanted the coating machine to start production as soon as possible in order to secure the financial future of the CDFDC. That impression was confirmed during the last day exchange of observations. First of all, the actual surface area of the plant is 120 m long by 50 m wide. At the utmost end, lengthwise, the coating machine is erected. The building, where the coating machine is erected, is separated from the main pilot plant by a narrow gangway of about 5 m wide. In that gangway the exhaust stack and main exhaust motor is installed.

The length of the first drying sectior is 12 m (3 zones of 4 m, each temperature controlled). The length of the second drying section : 20 m (5 zones of 4 m, each temperature controlled). Those dimensions correspond to a full fledged production machine for polyurethane coating of fabrics. In the same line, but at the other end, an inspection machine for the transfer paper is being installed.
An extension of the building by 50 m width-wise is possible. Mr. Cai Zhong Fang told me that this provision was made to install several more industrial coating machines in a second phase.
In total the whole space covered by the two buildings would be 120 m by 100 m, not counting the adjacent service buildings.
From this it's obvious to me, that the notion of a "Pilot Plant" is completely misleading.

It was also confirmed that the pilot plant, equipped with a complete range of industrial dyeing, printing and finishing machines for all types of natural and synthetic fiber cloths, at the end will be developed into a full scale integrated plant for polyurethane coated fabrics.
The sale of the production of coated qualities will have to finance further investments and the income generated by those sales must enable CDFDC to repay the loan of US$ 500.000, that was obtained from the authorities. That amount was informally cited by Mr. Cai Zhong Fang.
The production capacity of the installed plant must amount to about 10.000 m/day on a three shift basis, 10 m/min. running speed, at 70% overall efficiency.
Because for some qualities final finishing of the coated cloth, such as lackering, printing and siliconising, will eventually have to be done on the same machine, the actual production might be reduced to let's say 7.000 m to 8.000 m/day.
It's also obvious that, as long as there is only one coating machine, the capacity of the available dyeing and finishing equipment far exceeds the needs of the coating facility. Therefore subcontracting of dyeing and finishing orders for other mills will be done, in order to finance the research and development projects, and providing services to local textile industry, free of charge.

Regardless the decisions of UNIDO with respect to the full width printing facility, CDFDC will see to it there comes an industrial type of printing machine to complete their all round industrial activities and enhance their possibilities for development work and services.
What the exact relation or cooperation is with the Shanghai Textile Research Institute is not perfectly clear. The technicians who assisted at the trial runs in the pilot plant and at the technical discussions in the CDFDC, belonged both to the staff of CDFDC and of the Textile Research Institute. It was difficult to evaluate the theorical knowledge of the chemistry of polyurethane components of the staff. The longer the discussions went on, the more doubts were raised in my mind.

At the Shanghai Textile Research Institute some very small scale, elementary solving and mixing equipment is available.

How they are going to provide the coating machine with the necessary ready to use compounds in sufficient quantity is not clear. There is only one efficient solution : the installment of mixing and filtering equipment at the pilot plant.
I think that is also their firm intention, because a rather small warehouse for stocking base products is already erected at the pilot plant. According to the intended later development of the industrial coating section, it can be enlarged. Inside temperatures of the warehouse would be kept down by spraying water on the roof (!). I suggested the installment of airconditioning to function during the hottest time of the year.

Regarding the evaluation of the locally made coating machine, it is obvious that it cannot be compared to an European good quality made machine.
The designer of the machine, Mr. Wang Chang Cnun, senior engineer at the Shanghai Light Industry Engineering Design Institute, was at his third construction job and certainly must have had access to ample information on European built machines. The main important parts of the machine are solidly built and of good manufacture. The outlay of the ovensections, subdivided in temperature controlled zones of 4 m each, is adequate but the functioning not yet fully under control. The precision servicing of the laminating part will have to be refined. The main doctor blades on the two coatings heads were executed as a roller-type "blade", with two "in-cut" knives. That type of knife I did not see before, except for reverse roll coating techniques, but then without "in-cut" knives.
The exhaust ducts however were made and adapted at the spot according to outdated manufacturing methods. The awkward transition of square to round sections will reduce ventilation efficiency. Wiring ducts are too small, so that hundreds of wires are crammed and squeezed on top of each other, in too small a space. All dirt was going momentarily into the ducts. Not one part of the machine is painted yet. And I wonder if, once in production, it will ever be painted at all. Those remarks are of course elements that do not relate directly to the quality of the finished coated product.

Mr. Cai Zhong Fang was looking already ahead to see how and to whom he could sell the coated fabrics. I suggested to him he should look for a local garment manufacturer who would be willing to cut the production of the first let's say six months.

Undoubtedly there will be third choice production to throw away, but second choice and first choice, B-grade can be used for local manufacture, may be not necessarily for garments, but for the bag industry or other outlets. Only A-grade coated fabrics could eventually be considered for exports.

The CDFDC, seconded by the Shanghai Textile Research Institute, has the ability and the will to fulfill a useful development function. This function is subject to an autonomous financing ability, I think it's worthwhile promoting the creation of income for CDFDC, in order to let it reach its goals.
One has to take into account the limitations of the actual economic framework, in which the CDFDC should and can function. Therefore I suggested to Mr. Cai Zhong Fang a framework of activities that could be developed. Whether those acitivities should be developed solely by an enlarged staff of CDFDC, or by a combination with the staff of the Shanghai Textile Research Institute, is left in the middle and to both parties to convene.

C. Scheme for organisation and financing of Technological Centre

Sort of Activity	% of total stoff involved	Funding sources
1. Basic Research Projects	20%	Authorities : 100%
2. Applied Reserach Projects	30%	Authorities : 50% interested textile companies : 50%
3. Stand-by Personnel (visits mills in order to assist on the spot)	4%	textile industry : 100%

.../...

4. Technical Advisers (do not visit mills, but give advice of technicians at the Centre)	2%	Authorities : 100%
5. Services : consist of small groups of specialists or even one single technician specialized in a particular field or discipline		
- water	4%	Authorities should fund starting up the service e.g. for buying necessary equipment,laboratory installation, a.s.o. After two years each service should be selfsupporting by selling service to textile mills,which do not have the necessary specialists to solve their specific problems without assistance.
- noise	1%	
- solid waste	1%	
- energy	2%	
- colour matching	2%	
- computer-use and programming	2%	
- and other according to needs	2%	
- Technical Education and Formation - one-day lectures : for the Shanghai Textile Industry - three-day lectures : for the People's Republic of China e.g. on polyurethane coating		to be given by technicians and outside specialists self-supporting
6. Administration - Finance - Personnel Administration,a.s.o.	30%	
	100%	

The financing of the CDFDC's total budget could then happen roughly according the following scheme :

- contribution by every Textile Mill in Shanghai Area : +- 25%
- contribution by Authorities : +- 50%
- contribution by sale of services : +- 25%
- contribution for attendance to lectures : self-supporting

If Authorities would not intervene to that extent, then the budget should be balanced by the income generated by the sale of polyurethane coated fabrics and subcontracting orders for dyeing, printing and finishing of textiles. That income is of course diverted from possible investments needs for further expansion, development and renewing of equipment.

It was further observed that the pilot plant is some distance away (about half an hour by small bus) from the offices of CDFDC, presently located within the buildings of the Shanghai Textile Research Institute. For the purpose of production and development work in textiles, continuous supervision is required. The supervising engineers should be located at the pilot plant. Eventually consideration should be given to the provision of appropriate transport by a daily shuttle-bus. Compared to the European situation, very often a similar situation exists. Individuals provide each his own solution. The pilot plant had to be located in a new development zone and the exact area has been othermen's choice. Financial advantages and facilities must also have been present in the determination of that choice.

D. Further Development.

The state of transfercoating technology being in its infancy, it's useless to think of or to propose high level research activities in that field. However, it's of utmost importance to provide as quickly as possible the necessary mixing and filtering equipment in a dust-free room at the pilot plant. If necessary a more detailed proposal can be made, but we think the CDFDC is fully capable to determine what they need in that respect.

Further Mr. Cai Zong Fang seems obsessed with prices and finances. Only the cheapest product, the cheapest transfer paper come into consideration. He is not fully aware that one particular company cannot have the full variety of base products to cater for applications for different end-uses. Therefore some financing should be provided for the procurement of minimum quantities of base compounds from different firms and a sample roll of the most going types of transfer paper. Delivery of chemicals from Goodrich e.g. takes six weeks and that of transfer paper from Wiggins three months.

Furthermore, not the least type of laboratory equipment is present at the pilot plant. In the room where the laboratory coating machine is installed and in the adjacent room there is ample space to install some elementary needed equipment for testing the quality of the coatings. We suggest the following list : a precision weighing device, protected from draught from open windows, a pneumatic hydrostatic head measuring apparatus, an excicator to test air- and vapourpermeability, abrasion testing equipment for polyurethane coated materials, a Baillyflex-resistance meter, a strength- and tearstrength resistance meter, some laboratory mixing equipment, a household washing machine, a flask-drycleaning test apparatus, and a heating device to execute the one hour NaOH boiling test. The equipment available at the Shanghai Research Textile Institute is not adequate. By all means the above listed equipment should be installed at the pilot plant facility and not elsewhere.

E. Tasks.

The provision of above elements should enable the CDFDC to do a comparative study of the intrinsic qualities of different compounds, adapted to the intended end-use.

Further they must learn the effects of the different release papers on the topcoating compounds, the effect of glossy papers, the elements of lackering, silicon[illegible]sing and printing on polyurethane coated surfaces and later on some laminating techniques. The latter will necessitate further adaptations and additions of limited scope to the existing facility.

Further they must experiment with different types of base cloths and evaluate the effect of pretreatments of base cloths such as pre-shrinkage, pre-fluorcarbon treatments and the effect of resinfinishing of the base cloth upon the coating procedures.

A further usefull activity for CDFDC would be to advise on the modernisation of some older factories. The management of the visited mills is well aware of all those possibilities but is somehow, for unexplained but easy to guess reasons, limited in their initiatives to that respect.

However, it was pointed out during the visits to the three factories that :
- thorough cleaning and leveling of factory floors
- repairing or replacement of leaking steam valves
- automatic cold water output control
- automatic temperature control, regulating the quantity of hot water or supply of fresh steam

could bring tremendous savings in production costs, enabling very easily the financing of new investments, eventually from European origin.

It is however very difficult to judge from the viewpoint of our European Market oriented economic system and "thinking-process", what factors could motivate management to cut out those endless wastes.

ANNEX 1

A. Personnel contacts in CDFDC

Mr Cai Zhong Fang	Vice Director of CDFDC - Engineer
Mr Cai Pei Wei	Assistant to NPD - Senior Engineer Vice Director of Planning Department
Mr Cheng Cheng Kang	Vice secretary-general - Senior Engineer Director of Project Planning Department
Mr Shen Song Xiang	Director of Project Development Department Senior Engineer
Mr Shao Xinzhou	Senior Engineer
Mrs Chen Xiang Huong	Assistant engineer, main interpreter. Ms of Science in Chemistry
Mr Wu Pei Qiang	Assistant engineer, translater, interpreter
Mr Wang Chang Cnun	Senior engineer - Shanghai Light Industry Engineering Design Institute

B. Visit to Pilot Plant CDFDC

Several visits were made to the pilot plant. Following persons, not necessarily all of them on each one visit, participated :

Visiting group : Mr Cai Pei Wei
Mr Cai Zhong Fang
Mr Shen Song Xiang
Mr Wang Chang Cnun - designer of machine
Mr J.A. Jongbloet - UNIDO
and different technicians of the "coating department" of the Shanghai Textile Research Institute.

C. Other Contacts

Mr Ding - Director of CDFDC
Director of the first Shanghai Textile Bureau

visited the pilot plant.

ANNEX 2

Visit to : Shanghai N° 2 Dyeing and Printing Mill - 12.7.90

Personnel : Mr Fang Cia Xing - Vice Director
Mr Fei Hao Xin - Chief of Technological Section - Engineer
Mrs Zhou Pei Fen - Vice Chief of Technological Section - Engineer

Visitors : Mr Shen Song Xiang - CDFDC
Mrs Chen Xiang Huong - CDFDC
Mr J.A. Jongbloet - UNIDO

The factory was constructed in 1925, by Japanese owners, and was passed to the Chinese Government in 1949. It has been enlarged since. The factory is working 24 hours a day, in three shifts, six days a week, and employs 2.400 people, of which about 100 form the technical staff and about 200 the administrative staff.

Production capacity : 120.000.000 meters/year or 400.000 meter/day.

Present actual production : 250.000 m/day, or about 60% of capacity

About 70% of production is exported.

Qualities : cotton 100%, polyester-cotton 65/35% for a variety of sectors : sheeting, clothing, houselinen (table-cloth), upholstery fabrics, tenting, protective clothing for workwear.
Widths vary from 1.10 m (45") to 2.80 m (shirts and sheets).

Equipment and Processes.

Pretreatment :

- cotton : singe and quench in alkali
  Alkali scour in J-boxes, rope form
  Hypochlorite Bleach in J-Boxes, rope form

- polyester-cotton : continuous open width peroxyde bleaching

mercerising : 2 chain mercerisers
  1 chainless full width mercerising range

dyeing : continuous open width range, first part (Monforts) for dyeing the polyester part, second part (Benninger) for dyeing the cotton part - with large compensator in between-
  pad-dry - thermofix for polyester
  pad-steam for cotton, open width washing and soaping

printing : a number of copper roller rotating printing machines of local manufacture - complete with steaming and open width washing machines

finishing : a number of stenters - with padding mangles, a glasing three roller calander (Küsters), a number of hotflues for curing flame-resistant finishes - of which 50.000 m/day was treated - for all kind of applications. No resin finishing was practiced. Flameproofing combined with waterproofing was applied for tenting.

dyes : for cotton : reactive dyes, pigment dyes
  for polyester-cotton : disperse dyes

Waste water treatment plant : 7000 m3/day for 35 Tons of textile or 200 l/kg of textile.
  Initial BOD* of waste water : 150
  Initial COD** of waste water : 500
  BOD of effluent after treatment : 30
  COD of effluent after treatment : 100
Treatment consisted of airblowing in 4 similar round water tanks

* BOD stands for Biological Oxygen Demand
** COD stands for Chemical Oxygen Demand

Visit to : Shanghai N° 2 Printing and Dyeing Silk Factory - 13.7.90

Personnel :		
	Mr Lin Zongyi	Chief engineer Technical Staff
	Mr Xu Taixiang	Technology Developing Section Chief
	Mr Shao Jin Kang	Technology Developing Section Vice Chief
	Mr Jiang Yu Bai	Chief of Technical Department - Engineer

Visitors :		
	Mr Shen Song Xiang	CDFDC
	Mrs Chen Xiang Huong	CDFDC
	Mr Wu Pei Qiang	CDFDC
	Mr J.A. Jongbloet	UNIDO

This factory was fcunded in 1952 and consisted of a 4 story building. The factory is working 24 hours a day, three shifts, six days a week and employs 1200 people, including staff. "Snow Flake" is the well know brandname for its products. Also "Georgette with velvet flowers".

Production capacity : 150.000 m/day - 45" wide.

Present actual production : 100.000 m/day or about 66% of capacity

The silk production, about 10.000 m/day is totally exported to the U.S.A.

The polyester and polyamide cloth is for local consumption.

A small part of the polyamide cloth is coated with polyacrylates on solvent basis, still a smaller part is coated with a combination of polyacrylates and polyurethanes, also for the local market.

Equipment and Processes : (what I was shown)

- dyeing : - jiggers : about 20 machines dor dyeing light shades of polyamide
  - overflow : for dyeing polyester - two big machines
  - supporting equipment

- I was not shown the silk dyeing and printing department.

- A direct coating machine - acquired in 1986 - but of local manufacture designed by Mr. Lin Zongyi (Chief Engineer)- Only one airknife is available. Definite features of that machine are similar to those of the foreign acquired coating machine, described next.

- A coating machine for direct and transfer coating - acquired in 1985 - of german manufacture (Cotexma GmbH), one drying oven with stenter, laminating and batching equipment.

- A recovery plant for toluene of local construction is available. Toluene was absorbed from the exhaust fumes by active carbon. Subsequently the active carbon was flushed with steam. The condensate water and toluene are separated by gravity. Recovered toluene is only used for cleaning purposes and in "other places of the factory".

Visit to : Yong Xin Raincoat Dyeing and Weaving Works.

Personnel : Mr Yu Bai Ling - Senior Engineer of Clothing Production Section.
Mr Ghin Yun Ken - Engineer
Two other technicians.

Visitors : Mr Zhang Xinnong - Shanghai Textile Industrial Bureau Office of Leading Group for the main Industrial Programme of Coated and Laminated Fabrics.
Mr Shen Song Xiang CDFDC
Mr Chen Xiang Huong CDFDC
Mr Wu Pei Qiang CDFDC
Mr J.A. Jongbloet UNIDO

This factory originated about 60 years ago, but enlarged and modernised during the last decade.
It's an integrated company with weaving mill, transfered to the suburbs, dyeing and garment manufacturing. The brandname is "Great Ground" (in chinese da di). The factory is working 24 hours a day, three shifts, six days a week and employs 2500 people, staff included.

Production capacity : 180.000 m/day - 55.000.000 meters/year

Present actual production : 165.000 m/day - 50.000.000 m/year or about 92% of capacity.

About 70% of production is exported.

Qualities : - cotton 100% and
- polyester/cotton 65/35%, of which
  30.000 m dyed goods for own garment production
  70.000 m dyed goods for both export and inland consumption
  65.000 m bleached goods for both export and inland consumption

Garment manufacturing : 1.500.000 pieces/year or 5000 pcs/day

Type : raincoats, parka's, blousons, anoraks, protective clothing

Equipment and processes.

- Singe and quench in alkali, then in rope form
- two bleaching lines
- two mercerising lines

- Dyeing : - continuous pad steam dyeing with reactive dyes
  - continuous pad-dyeing - thermofix - drying line

- Finishing : - plenty of stenters - heatsetting machines and pre-shrinking machines of domestic manufacture
  - machine were neatly lined and working space was clean

- Coating : one Brückner direct coating machine with stenter - 6 fields - with pre-padder (Küsters) and drying section for slight waterproofing of cloth before coating. Installation 1983.

- Laminating : one Brückner laminating machine with 6 field stenter, a Jacob Weiss (Sinzheim - Germany) direct coating head in between, hot drum ironing section at the end. Installation 1989.

- Calendering - Embossing : a modern Ramisch three bowl calendering and/or embossing mangle.