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PILOT PROJECT IN PRODUCT ADAPTATION

DP/ROK/72/023

REPUBLIC OF KOREA

Technical report: Manufacture, dyeing and printing
of silk fabrics

Prepared for the Government of the Republic of Korea
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of René E. Barbe, expert in
the preparation, weaving, dyeing and printing of silk fabrics

United Nations Industrial Development Organization
Vienna

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Explanatory notes

References to dollars (\$) are to United States dollars, unless otherwise stated.

Use of a hyphen between dates (e.g., 1960-1965) indicates the full period involved, including the beginning and end years.

The following technical abbreviations are used in this publication:

t/m twist per metre

d denier

The following abbreviations of organizations are used in this publication:

KOTRA Korean Trade Promotion Corporation

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ABSTRACT

The Government of Korea requested assistance from the United Nations Development Programme (UNDP) for the project "Product Adaptation Revolving Fund" (DP/ROK/72/023). This request was approved and the project commenced in 1975. The United Nations Industrial Development Organization (UNIDO) was the executing agency and the Korean Trade Promotion Corporation (KOTRA) was the counterpart.

On 18 March 1978 an expert in the manufacturing of, and finishing processes for, lightweight silk fabrics was sent on mission to Korea for three months. The objective of this mission was to assist the manufacturers of silk products to improve the quality of their products thereby making them competitive in an international market.

In 1976, Korean silk exports amounted to \$56 million of which Japan bought 93% (\$55 million). In 1977, they reached \$73 million of which Japan bought 35% (\$62 million) and France, Hong Kong and Italy bought 10% (\$7.3 million). Importing countries have now raised their tariffs, especially on cheap items. The only way to avoid these tariffs is to produce items of high quality, if not of high technology.

According to studies carried out at five major firms, the equipment of Korean silk manufacturers is similar to that used in Western Europe before the Second World War. For the time being, this equipment is suitable for lightweight silk products for the traditional Japanese market and some overseas markets. Heavy items (kimonos) presently on the looms are not produced economically. So the main problems the manufacturers have to face are those of quality and improvement of equipment and processing. However, should new markets require heavier products, the present equipment would not be suitable and the manufacturers would have to consider investing in modern equipment such as automatic and shuttleless looms in greater widths (60 inches minimum), modern warping machines, heavy or two-in-one twistors, endless paper jacquard machines, continuous degumming, star winches, printing machines and stenter processing.

Owing to the development of world markets, silk manufacturers will have to produce new goods. This means that they will have to be well aware of world fashion trends and to keep up with these, the manufacturers subscribe to international fashion reviews and obtain samples from competitors. They also obtain valuable information from KOTRA branches all over the world. The Korean

silk industry sells on commission at competitive prices, mainly to Japanese customers. This policy, however, demands flexibility to meet requirements, which means the equipment is over- or under-used according to market trends.

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INTRODUCTION

The Government of Korea requested assistance from the United Nations Development Programme (UNDP) for the project "Product Adaptation Revolving Fund" (DP/ROK/72/023). This request was approved and the project commenced in 1975. The United Nations Industrial Development Organization (UNIDO) was the executing agency and the Korean Trade Promotion Corporation (KOTRA) was the counterpart.

The aims of the project were to assist KOTRA:

- (a) To determine the type of expertise needed;
- (b) To locate individual experts, consultant firms or manufacturing enterprises that could supply the needed expertise;
- (c) To negotiate with prospective suppliers of know-how.

Korean firms involved in the project were provided with consultant services in:

- Design and marketing
- Ceramics and chinaware
- Metallurgical processes
- Metallic sporting goods and metallic furniture

During the project, the focus shifted from emphasis on assistance with the design of product adaptation and marketing products to project development (particularly with international markets in mind), production methods and quality control.

Owing to the success of the initial stages of the project, the Government requested that the project be extended for five years (1977-1981).

In 1976, Korean silk exports amounted to \$56 million; 98% (\$55 million) of these goods were bought by Japan. In 1977, exports reached \$73 million of which 85% (\$62 million) were bought by Japan and 10% (\$7.3 million) were bought by France, Hong Kong and Italy. Importing countries have now raised their tariffs, especially on cheap items, and the only way to avoid these tariffs is to produce items of high quality if not of high technology.

On 18 March 1978 an expert in the manufacturing of, and finishing processes for, lightweight silk fabrics was sent on mission to Korea for three months. The objective of this mission was to assist the manufacturers of silk products to improve the quality of their products thereby, making them competitive in an international market.

The expert's first week was spent in Seoul meeting KOTRA officials and representatives of firms involved in the project and visiting two of the five firms that were taking part in the scheme. The second week was spent on a preliminary visit to the remaining three factories located in the south-eastern part of the country.

The expert then spent two weeks in each of these five factories, studying products and production processes and advising on possible improvements. All the factories are integrated, that is, they process silk goods from the raw silk to the finished fabric.

The expert's recommendations are contained in the body of the report.

I. FINDINGS

Exportation of silk fabrics

The total textile production for 1976 and 1977 is given in table 1; 90% was exported. Exports figures for silk goods for the same years are given in table 2. The value per square yard was \$9.33 in 1976 and \$7.76 in 1977.

Table 1. Total domestic textile production, 1976-1977

Year	Silk (%)	Other fibres (%)	Quality	
			Grey, bleached (%)	Finish (%)
1976	12	88		
1977	12.2	87.8	95	5

Table 2. Export value of silk goods and importing countries, 1976-1977

Country or area	Value (thousands of dollars)		Percentage of market	
	1976	1977	1976	1977
Japan	55 000	62 000	98	84.95
United States	600	1 700	1.07	2.32
France	26	1 600	0.046	2.20
Italy	28	1 700	0.050	2.60
Hong Kong	100	1 600	0.180	2.20
Others	246	4 200	0.440	5.73
Total	56 000	73 000		

The decrease in traditional markets, mainly the Japanese one (98% in 1976 against 84.95% in 1977), and increasing exports to international markets will force the Korean silk manufacturers to produce goods economically. The main items should be as follows:

Crêpe de chine, plain or jacquard, dyed or printed, in different widths

Warp = raw silk

Weft = two S and two Z picks, twisted alternately

Crêpon georgette

Warp = two S and two Z ends

Weft = two S and two Z picks twisted in one direction only

Satin crêpe

Striped crêpe

Kimonos and hobis for the Japanese market, dyed or printed (regular and beam).

Warp = raw silk

Weft = crêpe or untwisted yarn.

Visits to factories

The expert first visited all five factories involved in the project, then spent two weeks in each. His findings are reported below.^{1/}

First factory

1. The main factory is on three levels; its processes are preparation, plain and jacquard weaving, finishing and printing.
2. There is a newly-built factory on one level, apart from the main building where plain weaving only is carried out.

Second factory

3. The main factory is on two levels; its processes involve preparation, plain and jacquard weaving, finishing.
4. A newly-built factory, on two levels, is a few miles away from the main buildings: it involves preparation and plain weaving.
5. Main building is on two levels: its processes involve preparation, plain and jacquard weaving, and dyeing and printing, especially kimonos. There is also an annex, apart from the main building.
6. Another annex apart from the main building: processes beam-printed kimonos, printing and semi-hand weaving.

^{1/} The numbers are solely for ease of reference and do not represent any particular order.

Third factory

7. The main factory is on one level: it involves preparation and plain and jacquard weaving.
8. The finishing plant is apart from the main building.
9. A newly-built factory, on one level, is a few miles away from the main building: it deals with preparation and plain and jacquard weaving.

Fourth factory

10. The main factory deals with preparation, plain and jacquard weaving, finishing and yarn dyeing.
11. A newly-built factory, 80 miles away from the main building deals with preparation and plain weaving.

Fifth factory

12. All facilities are located in one building: preparation and weaving sections are on two levels; dyeing, finishing and printing are on four levels.

Technical studies at the factories

These studies include a brief description of the present equipment, the processing, and items that seem to need improvement or change.

Preparation

Oiling or soaking

Hanks of raw silk are placed in a cloth (cotton or other fibre) so as to form a bundle of roughly 2 kg, and then this bundle is placed in vats together with an oiling agent. This oiling agent was the same Japanese product except in one firm where it was made in Korea.

Some hours later the bundles are dried in a hydro-extractor and then the hanks are dried in a drying room and in some cases stored in the room where the hanks will be reeled. The main defect noticed was that the drying time was too long so that the hanks were excessively dry and stiff and thus difficult to handle. In one place only, where the percentage of product was lower and the time in the drying room very short, the expert found smooth hanks.

In another factory a sizing agent was added to the warp which made the hanks extremely stiff. The expert made the following recommendations:

1. No sizing agent should be added; sericin is the best agent.
2. The supplier's instructions should not be carried out exactly but experiments should be made to find the best conditions.
3. The time in the dryer should be reduced.
4. Hanks should be stored in the reeling room for as long as possible, and even kept in wet cotton cloths.

Reeling or bobbin winding

All the machines in use are of the same type: the take-up package is in the shape of flanged bobbins which are later turned to warp ends or crêpe. The disadvantage of this package is that it is not fitted for overend or off-winding processing for off-winding brings a few twists in the subsequent processes. The best package for off-winding is the biconical or "pineapple" type which provides the best unwinding as well as the highest speed. So it could be suggested to bobbin winding machine suppliers - Korean or Japanese - to study the way to get a pineapple take-up package together with a precision winding device. In most factories the yarn speed ranges between 200 and 232 m/min, except in one factory where the speed was only 130 m/min. It was advised that the speed should be increased to 250 m/min since the hanks in processing were extremely soft.

Twisting (SZ)

In twisting one, two or more ends previously assembled are twisted so as to alter the appearance of the yarn or to allow it to be used in further processes according to the number of twists. Packages are too small (125 g) whereas the current weights in modern twisters go to 450-500 g; that means that the work load per spindle will be less, and the number of spindles per operative, higher. As to twisting machine speed, it seems suitable for silk requirements. In order to twist crêpe to 2500-3000 t/m in one operation only, flyers are used. These flyers very often get worn out, especially in size alterations, so that the tensions are quite different from one spindle to the next, which produces yarns of different aspect. Very often, oily dust particles coming from the belt stick to the flyers, and then to the yarn, so that the take-up package appears with oily spots. Sometimes, owing to the condition of the driving belt, the yarn slips along the spindle so that parts appear somewhat twisted.

Usually high twist crêpe is twisted in two steps. First, after doubling, twist to 1,000 t/m. Second, twist to 1,800 t/m, either in twisting machine or in ring doubling twisting machine. The latter machine was seen only in one factory. This processing ensures a more regular thread. The immediate steps to be taken, without any alteration in the present facilities, would be:

- (a) To twist crêpe in two steps;
- (b) To check accurately the flyer conditions;
- (c) To clean regularly all working parts, especially the belt, the spindles and the take-up device;
- (d) To oil and grease running parts just enough not to spill dirt all over the machine.

The next important step, apart from using ring doubling twisting machines, would be to use two-in-one twisters or double torsion twisters by which for the same spindle speed, production is double. These machines have recently been developed and seem successful in the silk line. Table 3 gives details of standard twists.

Table 3. Standard twists (t/m)

Denier	Voile	Crêpe	High twist (Poil)
	(t/m)		
30	1800	3000	
40	1700	2900	
50	1600	2800	
60	1500	2600	
75	1350	2400	
100	1100	2200	3000
150	950	2000	2400
200	800	1900	2400
300	700	1800	2200

The formula usually used for crêpe (except 30 d and 40 d) is

$$\text{Twist/metre} = \frac{60,000}{\text{denier}} + 1600$$

Setting

Crêpe yarn produced in twisting machines is difficult to handle because of its "springy" condition. Setting consists of temporarily taking out this

spring so that it looks like an ordinary non-twisted yarn and can be dealt with easily in further processes. Setting is usually carried out in steam-heated apparatus, sometimes in a vacuum, at temperatures and periods that differ according to the type of yarn. The expert found temperatures were generally too high and processing periods too short. He therefore advised that the temperature be reduced and the time increased so that the yarn might release quietly. Too high a temperature takes so much spring out of crêpe yarn that it can not recover and looks like a "dead" or "killed" yarn. Also, in most cases, checking apparatus were inaccurate.

Warping

This operation consists in winding onto a drum the total number of ends according to the number of ends required by the width and length of the fabric. Then these yarn are rewound onto loom beams, a process known as beaming.

Creels. Most creels contain 2 x 200 ends. In one factory the expert noticed creels of 800 ends but used with 400 because they were fitted for the reserve process. Tension devices were sometimes wrongly set and the difference in tension caused stripes in the fabric. All the creels, except some old ones, have an inside yarn frame, whereas modern creels have an outside yarn frame. Owing to the weight of the supply package (375 g) allowing many hours of warping, it is not advisable to use an 800-end creel as a reserve creel. It would be better to reduce the number of sections (of 400 ends), the average being now 40-50 sections per beam. The stop motion device should operate at once.

Warpers. All warpers used in Korean silk factories are of the sectional type which best suits the silk industry requirements. They are fixed, facing a movable creel that follows the movement of the section when wound on the drum. The speeds were checked and are normal: 300-350 m/min. The creel stop motion appears slow to operate in case of breakage. Also the belt brake, which should stop the drum immediately, is so weak that the broken end is lost on the drum which continues running two or three times (10 or 15 m) after the stop device has been operated. The operative then has to run the drum backwards until she finds the broken end.

While so doing, she winds the section on her hand (handling), knots the broken end from the drum to the end that she finds on the creel, and releases the section while the drum runs slowly forward.

This process is wrong because (a) handling the silk spoils it; and (b) when releasing the silk forward at low speed, the tension is different from that observed during the normal course of warping. This process, which was used many years ago, has now been replaced by the following one. When a breakage of warp end occurs, the operative tightens the broken end on the drum to the next end, finds the broken end on the creel, passes it through the reeds and tightens it to the next end. When warping, the first broken end that appears is knotted to a spare bobbin until the second broken end comes in sight. However, this process cannot be carried out on the present warpers as, when beaming, the warp has to go through seven rollers, 1.50 m long, that prevent any work from the beaming side of the warper.

It is suggested that warpers be fitted with high efficiency (motor) brakes and a quick operation stop motion device so that the drum stops immediately a breakage occurs. Also, the lease reed should be thicker with less ends per dent. The expert found lease reeds of 23 dents with 36 ends per dent.

To avoid stripes, it would be better to have a reed of 49 dents with 14 ends/dent, or a reed of 57 dents with 12 ends/dent.

Pirn winding

Most weaving defects are caused by the bad conditions in pirn winding. The equipment is either worn out or its precision is faulty. Korean silk manufacturers should invest first of all in modern and accurate pirn winding machines.

Weaving

Plain and doobby

On the whole the equipment for plain weaving is fairly good. None of the looms are old and most are newly-built. None are automatic, they are fitted with an electro-weft feeler, which should operate on the single box side but often operates on the wrong side. In some factories, to save material, the operative goes on weaving until the very last metres of silk are on the pirn. There were no spare shuttles except in one factory where operatives on kimonos had one spare shuttle to prevent a mix-up of the two twists S and Z.

Some of the clutches are either worn out or dirty and according to the way the operatives start the loom, a weft mark is produced. Reeds are in

fairly good condition although in some factories heavy reed marks were noted all along pieces. Loom speed is rather low and it could be increased without affecting the warp. Some looms recently put into operation are not running at the normal speed. Brakes are weak, either from their construction or from oil on the leather part. In most cases, owing to the density of ends, there is no warp stop motion device. Sometimes there are no lease rods although they are very useful in case of warp breakages or neps (slubs). Shuttles are stuffed with either fur or nylon loops; sometimes they are worn out.

As to the quality of raw silk, the expert noticed many slubs but did not have sufficient information to discover their cause.

Jacquard weaving

All the jacquard looms are obsolete and need to be changed. Coarse cardboard should not be used because it weighs too much, it gets damp, which causes defects, and it is quickly worn out. Their main production is kimonos, in one or two widths, and some are used for crêpe jacquard.

Defects

Warp defects. The main defects in grey are section marks caused by the following:

- (a) A difference in tension on some bobbins on the creel;
- (b) Irregular tension in warping when repairing a broken end;
- (c) Irregular tension between the lease reed and the drum;
- (d) Irregular twisting;
- (e) Broken ends repaired under different tension;
- (f) A reed in bad condition with dents either worn out all along the shuttle slide, twisted or of irregular width;
- (g) Slubs;
- (h) One end breaking and getting entangled with the next one.

Stitchings occur in jacquard when ends do not come down quickly through the legs owing to the density of warp ends. If this is caused by the cardboard pattern being in a poor condition, such stitchings are found at each repeat.

Weft defect. The main weft defects are caused by a difference, which may be very small, of density in the weft. This comes from the way the loom is started and the way adjustments are carried out after a weft breakage or after unravelling (deweaving). When such defects appear in the fabric, although they may be of minor importance, the operative has to take out the woven fabric as far as the defective point. In doing so, she spoils the yarn which, even if the adjustment is good, results in a major defect all through the fabric. Other defects are broken wefts when the weft feeler fails to act; slubs in the weft; and the fall of the weft from the pirn.

General defects. Some general defects were oil or greasy spots due to over-oiling of machinery. The expert also observed black spots, spread over the fabric, that were produced by particles of dust that stuck to the reed. Also, the rubbing of the warp against the reed produces a thin dust which gets black if the reed and other parts are dirty. Irregular defects are caused by an irregular warp supply.

To prevent such defects it is recommended:

1. To carefully check the tension on the creel.
2. To adjust the cone height as much as possible.
3. To make the drum stop instantly so that the operative does not have to unwind the section to find the broken end on the drum.
4. To ensure the best lease reed density to avoid twisted ends.
5. To check twisting conditions for tension, spindle speed, flyers and belt condition and cleanness of all running parts.
6. To have somebody responsible for the reeds who is able to carry out maintenance duties.
7. To ask the operative in weaving to watch carefully not only the front part of the looms, but also the rear to prevent defects.
8. Some operatives are of a low technical level and defects were detected only during inspections. Therefore, a highly skilled weaver or operative from another section should be in charge of permanent quality checking, that is, patrolling the looms and advising operatives in case of trouble. This adviser could also teach low-skilled operatives the proper methods of operation and, on three or four spare looms, teach trainees.

9. When starting a new beam, a preventive maintenance scheme should be set up to ensure the best weaving conditions.
10. A list should be made of loom or machine parts that need checking or changing in the course of the next few running hours or days, and this work should be carefully carried out.
11. To stop the process of unravelling (deweaving) because it causes a major defect throughout the fabric. It will be up to the operative to decide whether the defect needs unravelling but he should report to the quality checker.
12. As soon as a new beam is on the loom, a "tirelle" or sample of woven fabric of 0.5-1 m should be inspected, first in grey, and then in the laboratory so as to detect very quickly any possible defect.
13. The fur and nylon loops should be checked and changed frequently.

Inspection in grey and mending

Through the inspection in grey, defects are detected as quickly as possible. Most of the time this inspection is carried out on hand-operated tables. However, there are inexpensive motor-driven tables which would allow a higher production.

Different motor driven tables with sliding seats allow the mending of broad fabrics by only one operative.

Degumming

Degumming is carried out without any prior soaking except in two factories. Fabrics are hung on rods and dipped into two baths: first, into a alkaline one, then into a weaker soap bath (either paste or solution being used) with a liquor ratio of 1/50 or 1/40. Although modern devices allow an accurate check of the pH the most common way is the pH paper. In certain factories the pH seemed too high. Degumming times are similar in most factories but there is no method of checking them. In some factories, the loss of fibroin, which should be 20%, is as high as 25%-27%.

Some manufacturers also complain of "louisiness" as well as spots that appear only on degummed fabrics and which are likely to come from undissolved soda-ash particles. Louisiness may arise from the nature of the raw silk.

The expert advised that the complete degumming process should be checked by using picrocarmine, although this is not a certain method of ensuring that the degumming is correct. Another defect degumming might cause is irregular weftwise crêpe shrinkage. The expert advised that the fabric, instead of being hung on rods, should be pinned directly onto round or square frames.

Dyeing

Piece dyeing

Dyeing is carried out in different types of equipment, such as open vats, open winches, jiggers and, in one factory, beam machines.

Acid dyestuffs are the most commonly used owing to their qualities of brightness and fastness. Nevertheless, some factories were using neutral dyestuffs. As dyestuff dealers supply their customers with all particulars on their own products no advice on this subject was necessary from the expert. However, when preparing dyeing solutions care must be taken to prevent uneven dyeing.

The expert did advise on the equipment. Open winches should not be used for crêpe fabrics weighing over 100 g/m^2 because of the danger of the fabric slipping over the drum thus producing white marks. The expert advised factories that had three-reel winches to use them only after wrapping the ribs of the reels with cotton cloth to prevent slipping. When jiggers are used, the extra piece of fabric linking the silk fabric to the drum absorbs dyestuff and shades the silk fabric. This might be prevented by making the extra piece of a non-absorbing fibre.

In beam dyeing, with high temperature facilities but used at lower temperatures, the main defect is "moiré" caused by the tension of winding. The tension must be tested and adjusted according to the type of fabric.

In three factories there are no laboratory facilities, just some glass apparatus and, in one, a high-temperature device and other items. In the last factory, the laboratory facilities were of a European level in respect to equipment, location, staff etc.

Dyeing on star winches is unknown in Korea. Only in one case was a double width star winch for kimonos seen but it was not used. This kind of winch is very useful for crêpe chiffon (1 twist) to get a levelled shrinkage.

Washing after dyeing is usually carried out in the machine where the fabric has been dyed. Horizontal mloop driers are in use in nearly every factory. Temperatures of 120°-130°C were noticed, which are too high. They should not exceed 80°-90°C for a speed of 20-30 m/min.

Yarn dyeing

The expert inspected the yarn dyeing facilities at two factories. The dyeing of blended fabrics, silk/Bemberg, is done in one bath resulting in a difference in the appearance of the fabric. The best method is the two-bath one: acid for silk, direct for Bemberg, although this takes longer.

Printing

General printing

The so-called hand-printed fabrics are done by a hand-operated machine. Usually hand-printing is done by a log of wood, roughly 30 x 30 cm, that has had the pattern carved on it and which is hand-pressed onto the fabric. There are as many logs as there are colours.

In screen-printing, the pattern is reproduced on very thin polyester; parts of the pattern are filled with emulsion, other parts are left uncovered so that the colour, applied by means of a squeegee, goes through the open parts and onto the fabric. There are as many screens as colours. Printing is carried out on inclined tables on which the fabric is stuck. Screens are moved along the table according to the repeat and the number of colours. This is different from industrial production which is carried out on flat tables, the screen being placed on a carriage driven automatically either by air or a motor. The appearance of the fabric is the same since the only difference is the way the screen is carried from one repeat to the next. The expert advised that flat tables with automatic carriage be used and gave detailed drawings of the equipment, tables, screen carriage, under-cloth liner etc.

Setting

After printing, the fabric has to be set so that the colour be fixed onto the silk. To achieve this, two different processes are used:

Current printed goods

These are pinned on square frames, placed in steam-heated rooms and kept for a while at 95°C. The temperature was right but too much time was allowed, generally 30 minutes in saturated steam.

Discharged colours

On a ground prepared with special dyestuffs are printed patterns with colours that destroy the ground colours leaving a white or differently coloured pattern. The setting for discharged colours is usually 10 to 15 minutes

Washing

When set, fabrics have to be washed to remove the excess of colour that has not been fixed onto the silk. In two factories, hand or broom washing was still used and this must be given up. The open width washing machines, which are widely used in western countries, are rare but these meet all requirements and should be used after dyeing or printing. They have a vacuum drier that does not spoil silk fabric as much as the hydroextractor.

Finishing

Finishing includes all operations, after dyeing, that add materials to the fabric and affect the final appearance, such as the following:

Stentering or tentering

The fabric is held between two chains maintaining weft tension and width. Stenters are the main equipment in all finishing processes. Some firms did not have stenters. The ones that did had improved them by setting steam devices in the feed and exit zones. Normally, all crêpe fabrics should go through stenters to be stretched to the required width which allows roughly 13% shrinkage.

Felt calender

As with the stenter, the fabric is pinned to a drum which carries it between a large steam-heated drum and an endless felt cloth. Such processing gives the fabric a smooth, shiny look and helps to maintain the width. Stentering is better than felt calendering for the control of shrinkage.

Decatizing or palmer

This process is similar to felt calendering but the results are much better for the width setting and the general appearance.

Padder (pad)

The expert saw padders in only two factories, both of them dealing with

cotton or man-made fibres. For crêpe processings padders are useless. They would be useful for special finishes such as wash-and-wear or anti-crease. The expert provided formulas for the wash-and-wear treatment using silicone but this product is not available in Korea at present.

Special items

Hand-printed kimonos

Stencils used to outline sketches to be painted are still hand-made. The expert suggested that the patterns be printed on the kimono fabric by a simple screen device together with wax which would prevent further dyeing. This wax coating would later be taken away to reveal only the outline of the sketch to be hand-painted.

Beam-printed kimonos

The usual processing for beam-dyed fabrics is as follows:

Weave at 4-5 pick/cm with a strong weft yarn, i.e. organzine or nylon

Print

Set

Wash

Deweave or take out the weft of the first weaving

These operations are carried out either on the loom itself (discontinuous weaving) or by warper and rebeaming, and then the fabric is woven at the normal density. In order to achieve higher productivity the expert recommends that this process be used if the customers agree because it might alter the appearance of the beam-dyed kimonos. Technical assistance for these two special items would require at least two months to be efficient.

II. CONCLUSIONS

The Korean silk manufacturers whose facilities suit the requirements of the present crêpe market are faced with the problem of quality. Foreign buyers are interested in high quality crêpe de chine, especially in a width of 140 cm (55 in.). Manufacturers want to be able to rely on a regular quality. Steps to ensure this are given below.

1. Measures should be taken to check the working conditions at every stage, from preparation to finishing through weaving, which requires the most attention.
2. The first slip of cloth produced after a loom has been set should be tested immediately.
3. Quality control should be established, especially in weaving, by having a highly-skilled operative patrol to prevent and detect defects and give advice to the operative.
4. Training within the section should be established. The quality control checkers could train low-level operatives.
5. A list of parts that need checking or changing should be prepared and a preventive maintenance scheme established.

Usually loom manufacturers supply the check-list and the pre-maintenance scheme suitable to their own equipment. In the case of old looms, setters-up can provide valuable information.

The management of most of the firms was keen on keeping in contact with foreign markets and producing novelties. The expert showed them samples and, in one case, helped to make samples after adapting the design to the Korean way of drawing.

III. RECOMMENDATIONS

Owing to the present Korean export policy towards world-wide markets, Korean silk manufacturers will be faced with new problems concerning equipment.

When planning new investments, the manufacturers should order the following:

Biconical or pineapple take-up packages

Ring doubling twisting machines and two-for-one twisters

Modern warpers and high capacity creels with accurate tension checking devices

High precision pirn winding machines or "UNIFIL" set on looms

Automatic pirn changing looms in 130 cm (70 in.) normal width feed from stack

Shuttleless looms of the rapier type in widths ranging from 160 cm (63 in.) to 265 cm (104 in.) in from four to six colours

Positive dobby, 1 and 2 pattern-card cylinders, motor-driven pick-finder

Endless paper jacquard machines (Verdol type)

Efficient visiting and mending machines

Continuous or open width degumming machine

Open width washing machines

Stenter with padder, steaming and felt calender in one range

As equipment such as jacquard reading and punching pattern paper and open width degumming machines is expensive, silk manufacturers might set up a joint venture company that would be working for the joint partners as well as on commission.

GLOSSARY

Processes

A woven fabric includes two components: the warp running lengthwise and the weft (filling) running widthwise, both interlaced according to the weave which may be plain, dobby or jacquard. Some fabrics are made of two or more different warps and from two to seven different wefts. After being woven, the fabric, if piece-dyed, is dyed, printed and finished or, if yarn-dyed, only finished.

Terms

Cam

A device that operates the warp yarns but is limited to the basic weaves. Eight cams are the maximum.

Creel

Frame supporting the supply packages in warping.

Crêpe

Two or more silk yarns twisted together up to 2500-3000 t/m. When treated in hot water, this yarn shrinks giving a special appearance to the fabric

Chiffon

A crepe fabric in which one twist only is used

Doubling

Two or three silk yarns are assembled before twisting

Degum-
ming

Two components of raw silk are sericin (20% - 22%) and fibroin. When silk is placed in boiling water, the sericin dissolves and only the fibroin remains. This process is called degumming

Decitex-
denier

This is a direct means of evaluating the thickness of filament threads. One international denier is the weight (0.05 g) of 450 metres or in 1 g there are 9000 m. This method of evaluation has now been replaced by the decitex in which 10,000 m weigh 1 gram. The higher the number of deniers or decitex, the thicker the yarn.

Dobby

A device that operates the warp yarn for any kind of weave up to 24 ends

Draw-
in

The order according to which warp ends are passed through the healds

Fibroin

See degumming

Finish

Products applied to the fabrics after bleaching, dyeing or printing to alter their characteristics. Finishing includes all the operations after weaving, starting with the grey fabrics

Jacquard

A device to operate a great number of warp ends up to 1344 ends in different ways so as to produce wide patterns

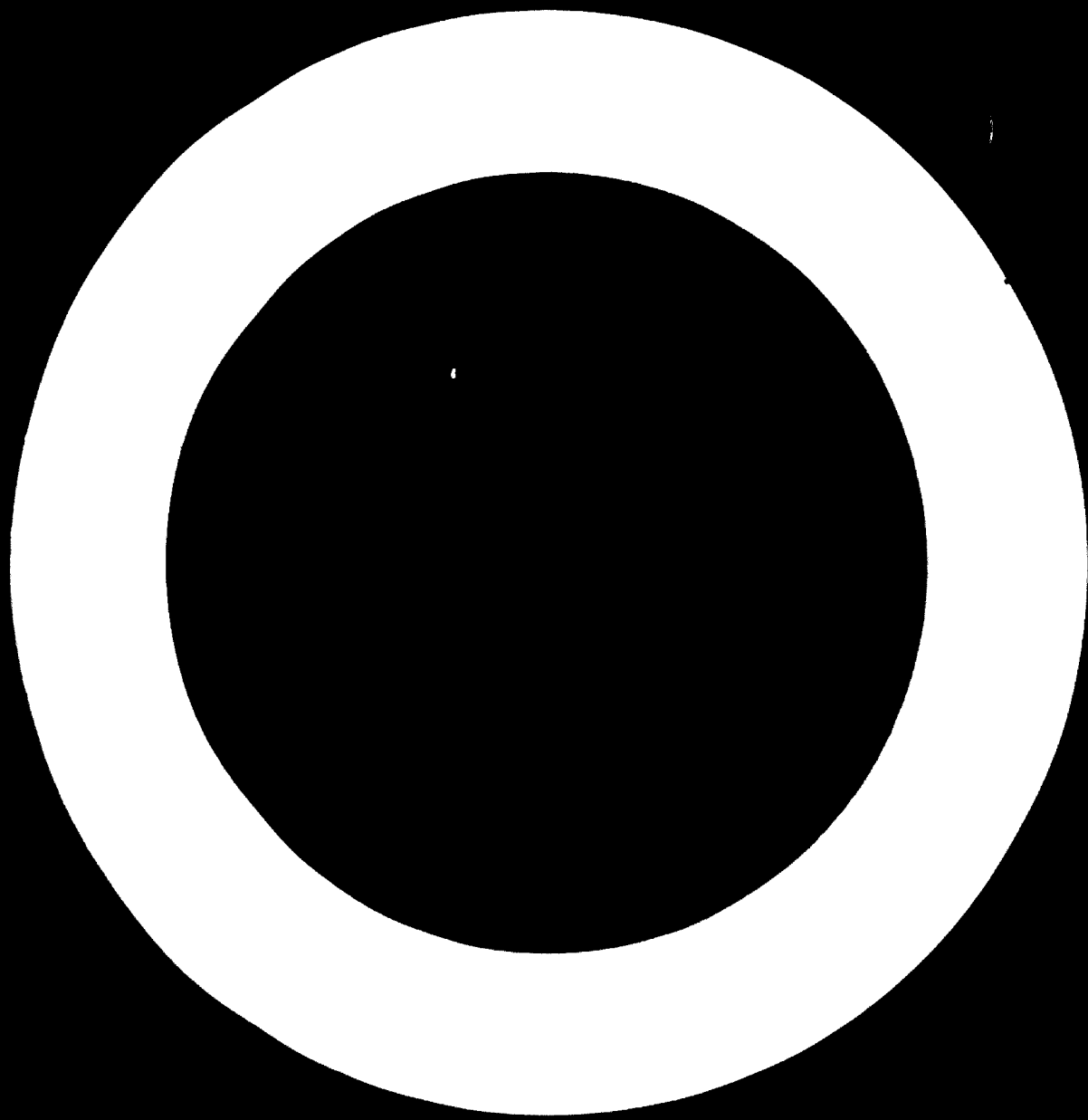
Hanks

Package in which raw silk is supplied by the spinners

Heald

A flat or round wire with a hole in it through which the warp end is passed so that it may act according to the weave and the draw in

<u>Metric number</u>	This is the number of 1,000-metre lengths in 1 kg. The higher the number, the thinner the thread
<u>Oiling</u>	Prior to any operation, silk is soaked in certain products to make it smooth and so easier to handle
<u>Pirn</u>	Wooden piece that contains the weft yarn; it is placed in the shuttle
<u>Preparation</u>	This includes all the operations performed prior to weaving: Oiling (soaking) Reeling (bobbin winding) Warping Throwing (twisting) Pirn winding
<u>Plain</u>	Plain weaving includes the taffeta weave (1 and 1) and basic weaves, satin, serge etc.
<u>Ply</u>	The number of ends acting together in warp threads
<u>Reed</u>	A comb-like device through the dents of which warp ends are passed. For instance 65/2/3 means a reed of 65 dents with 2 ends of three-ply in each dent
<u>Reeling</u>	To wind silk from hanks to bobbins
<u>Repeat</u>	The number of ends in the weave. In taffetas the repeat is 2, for satin of 8, it is 8, in dobby weaving, up to 24, in jacquard, up to 1344
<u>Sericin</u>	See degumming
<u>Setting</u>	When twisted, silk yarn has a tendency to turn to gimlet so it is not possible to use it directly. After twisting, it has to be set, that is, to have the "spring" taken out. After printing, colours have to be fixed to the fabric and this operation is also called setting
<u>Twist</u>	There are two twists: S and Z. One yarn or assembly yarns are given a number of twist either to be used later or to alter the qualities of the yarn
<u>Warper</u>	Machine to set the total ends of the fabric in the required width
<u>Weave</u>	The way warp ends and weft are interlaced



Annex

JOB DESCRIPTION

Post title: Adviser on the Manufacture of Light Silk Fabrics

Duration: Two months

Date required: As soon as possible

Duty station: Seoul; with travel within the country

Duties: The expert will be attached to the Korean Trade Promotion Corporation and in collaboration with the Corporation will assist manufacturers of silk fabrics in improving the quality of their products and in making them competitive in the international market. The expert will specifically be expected to:

1. Visit plants of silk manufacturers
2. Study their current products and production processes, and advise on the improvements thereof.
3. Participate in seminars held among silk manufacturers to discuss day-to-day manufacturing problems, and latest technical developments in the field.

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

Qualifications: Textile technologist with extensive experience as Senior Technical Officer with a silk manufacturing firm preferably in Italy, France, Switzerland or Federal Republic of Germany. Excellent theoretical knowledge of silk production technology.

Language: English

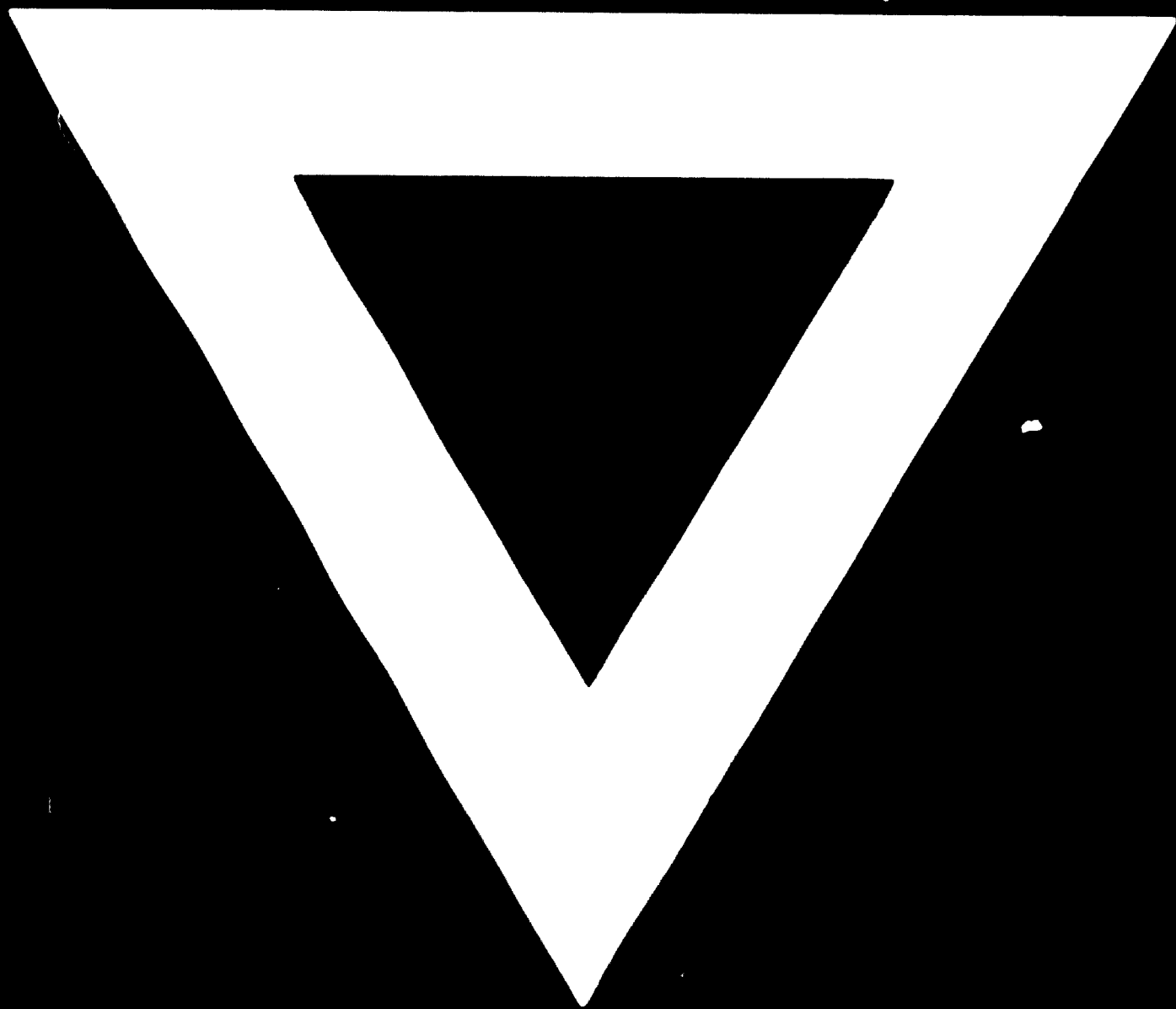
Background information: The project is aimed at assisting the Republic of Korea in achieving its planned export targets through developing and improving the production capacity for export products to selected foreign markets.

The project is attached to the Korean Trade Promotion Corporation (KOTRA) founded in 1962 and supervised by the Ministry of Commerce and Industry.



KOTRA is responsible for implementing Korea's export promotion drive. It maintains a network of branches overseas. KOTRA's main activities have been in the marketing sphere. To ensure better results it was decided to introduce a product adaptation programme to complement marketing activities by strengthening their assistance to Korean manufacturers to adapt their products or production processes to the requirements of a particular foreign market.

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