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APPROPRIATE TECHNOLOGY FOR THE PRODUCTION OF TEXTILES

APPROPRIATE TECHNOLOGY IN THE TEXTILE INDUSTRY OF SRI LANKA .
Background Paper

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APPROPRIATE TECHNOLOGY
IN THE
TEXTILE INDUSTRY OF SRI LANKA

by

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1. INTRODUCTION:

1.1. Cotton Textile Industry is historically the first step in the process of industrialization of a country. Most of the newly emerging countries of the Third World, therefore, usually start with industrialization by installing cotton textile industry. Sri Lanka is no exception.

1.2 Cotton Spinning and weaving industry in Sri Lanka has been in existance for so long that its beginning can not be dated. Whether there was local perennial cotton plants or not is uncertain, but th Portuguese who occupied the country in the seventeeth century must have introduced the New World cottons as indeed they did in their territories of Goa and Daman on the Indian mainland (Afzal & Kamal, 1957) these cottons, however, failed to take a foothold. In any case the traditional trade with Southern India could account for the import of raw cotton where the perennial Razi Cotton was well established in olden times.

1.3 In those days home spinning and hand-loom weaving was the rule and the size of the industry could not have been very big as local production of raw cotton was very limited and utility textiles could be easily brought from

India. It has to be remembered that India was the biggest manufacturer of cotton textiles from about 1500 BC to 1500 AD (Afzal, 1968, page 2). The local spinning and weaving industry in Sri Lanka seems to have developed into speciallity products of which the Batik printed cloth is in production today.

1.4 The modern textile industry in Sri Lanka had its beginning in the 1930 and today there are nine mills with 269,740 spindles and 2650 looms. There are 5,133 power looms run by the Government Department of Small Industries and various cooperatives. In addition there are more looms in the unorganized sector, of which about 100,000 are hand-looms devoted to the production of cheap cloth without any quality control and 1,308 looms for weaving nylon Saris and suiting cloth. The local industry is obviously not in a position to meet the internal demand for textiles of the present population of 14.5 million and the country imports large quantities of piece-goods annually from abroad. This is a very serious drain on the foreign exchange resources of the country. The industry needs to be expanded considerably.

2. The infrastructure

2.1 It is essential for the new nations of the Third World to improve their economic condition and the urban-rural balance. In Sri Lanka about 55 percent of active labour force is still employed in agriculture. The country

is, however, fortunate in having three highly remunerative crops, viz; tea, rubber and coco-nuts, but the country does not produce enough rice to meet its needs.

Summary Economic Survey

2.2 The country is fairly well off amongste the Third World countries, and the percapita annual GNP is about US $ 200.00.

2.3 It has been the traditional role of agriculture to supply both the capital and the man-power required for industrial expansion in the initial stages. Later on, of course, the industries them-selves provide the capital for replacements, modernization and sophistication. It is fortunate that Sri Lanka has a very strong agricultural base and can, if it wishes, quickly develop a variety of industries; literacy (about 85%) and other conditions like roads and electricity are also propitious. Unfortunately, however, the pace of industrialization is very slow. Qureshi (1976) has given a few income and outgo figures of Sri Lanka for 1970. The following are of interest in the present context.

Payments for transfer of technology in million dollars.

a) Patents, licenses, know-how -- = 0.1

b) Management and other Technical Services. = 9.2

Total = 9.3

2.4 It can be seen that very little effort is being made to establish new industries, but huge sums are being spent on getting advice and services from abroad. It is under these circumstances that Appropriate Technology can have a major role to pay so that more money is spent on t the unembodied technology (know how and patent information) and less on embodied technology (finished producte and machinery) and services. This is especially important at present since the Government of Sri Lanka has decided to establish a Free Trade Zone near Colombo. Careful study of induetries to be stablished in the FTZ and the level of technology to be imported should be undertaken immediately.

3. Raw Cotton

3.1 At present raw cotton is produced in a very small way about 1000 bales annually in Uda Wallawe tract in the eouth of the country where the rainfall is about 500 cm a yeer. There are two rainy seasons in this part, the summer and winter monsoons. Such a climate is obviously unsuitable for cotton production as cotton requires a dry season during the mauration period of bolls.

3.2 It is, however, anticipated that cotton will be an important crop in the Mahawali Diversion Scheme in the northern, comparetively dry, part of the country. The present thinking is that there will ultimately be about 30,000 acres annually under cotton. The local cotton production will even then be in sufficient, but it will be

a good beginning. In this connsction one can hopefully expect that the Government will start experimental work on crops right now so that the Agricultural Department is ready with all the answers when the water actually starts flowing in irrigation channels after about seven years. It is aleo suggested that experimental work on cotton should lay emphasis on the production of extra long staple cottons. In latitude and climate similar to that of SRI LANKA, Sea Island Cotton is grown in the West Indies perticularly in St-Vincent and certain island in the Pacific Ocean. If Sea Island cotton can be establshed, Sri-Lanka will have a ready supply of the best cotton in the world which can also be export if with great advantage.

4. The need for textile industry.

4.1 The economy of Sri Lanka is at present being supported by three valuable crops; tea; rubber and coconuts. Such crops have their own ups and downs. Tea can be challenged by coffee and cocoa and natural rubber by synthetic rubber. It is, therefore, best for all countries of the Third World to prop up their economies in the early stages by such industries as the cotton textiles.

4.2 The present cotton textile industry of Sri Lanka is totally inadequate to supply the population with 12 yards of cloth per person per annum and huge quantities of piece goods are imported. To choose a suitable production line of machinery for the new cotton textile mills offers

an excellent chance to improvise and adapt the machinery according to the local needs.

4.3 It must, however, be mentioned that the cotton textile machinery has moved up from the ' MULE' to 'Open-End', sliver-to-yarn and twistless spinning. Most of the preparatory processes like the blow room, cards, draw frames etc. have also undergone many changes. There are spinning frames with no spindles and looms without shuttles. There is also the textured yarn. The raw material has also undergone a transformation from the coarse and harsh Asian Arboreums, half and half type of hirsutums to fine and extra fine hirsutums and barbadense cottons and a bewildering variety of man made fibres. This variability within the available choices of the raw materials and the machines offers an excellent chance of improvisation. But the task is rendered difficult because the verticle flexibility in the assembly of the machinery in a mill is small and the options are limited. Nevertheless appropriate technology still has a part to play.

5. SOME FUNDAMENTAL ASPECTS OF THE PROBLEM

5.1 The first consideration is that the consumer requirements of cloth should be surveyed.

5.2 In Sri Lanka, the traditional wearing apparel of men is either a Sarong or trousers while the women wear

either a Sari, Skirt, trousers or a Sarong. As the general population is poor, there is a great demand for strong cloth which will last long. But fabrics of non-cellulosic fibres are uncomfortable in hot and humid climate of Sri Lanka. The best compromise would appear to be the blended fabrics made from blends of cotton and man- made fibres. In Sri Lanka such blended fabrics have a bright future and the new textile mills should be set up with this consideration in view. A nylon plant is under construction at present.

5.3 The choice of machinery for the new mills will determine the range of appropriate technology. Or, better still, the level of appropriate technology envisaged for a country will determine the appropriate type of machinery.

5.4 In the field of textiles, minimum technology would be a hand loom which employs one operator as against several, automatic shuttleless weaving machines being looked after by one operator. The other extrememe example would be of a fully automated plant with chutefeed, cross roll verga cards, shuttleless looms and continuous finishing process. This would mean a very high level of technology but minimum labour employment.

5.5 For each country there is an optimum level of selection of appropriate technology, and therefore, the level of sophistification of machines. However, at the

optimum level the labour cost and machine cost will not be the only factors to be considered for a given amount and quality of production.

5.6 In order to illustrate the costs involved in the two extreme cases mentioned, viz, the hand loom and shuttle-less weaving machines, it is presumed that fabric produced is coarse, has 40PPI, but differences due to quality have been disregarded. A more accurate model would not only take into account the quality but also the cost of back process. For the sake of a simplicity these have not been taken into account.

5.7 MINIMUM TECHNOLOGY:

5.7.1. If minimum of technology is used it would result in maximum employment. In the case of a handloom One operator is employed to operate one hand Loom.

PRODUCTION OF CLOTH OF 40PPI PER 8 HOURSHIFT = 8 yds.

Production per hour per operator = 1 yard.

Time required to produce 100,000 yds = 100,000 hours.

Labour cost at the rate of Rs. 0.75/hr = 75,000/=

Cost of one handloom = 2,000/=

Assuming the life of handloom to be 5 years.

Machine cost/hour = Rs. 2000/= 8 hrs/day x 200 Working day / year x 5 years = $\frac{2000}{1600}$ = Rs. 0.25

Total labour+Machine costs Rs.75,000/=+Rs.25,000/= Rs.100,000/= or Total Cost per year = Rs. 1/=

5.8 MAXIMUM TECHNOLOGY

5.8.1 This would mean a highly sophisticated and automated machine which would have high rate of production and a number of such machines would be looked after by one operator.

Production of one shuttleless weaving machine at 300 ppm being 92% efficiency.

$$= \frac{300 \times 3 \text{ Width} \times 60 \text{ min}}{40\text{PPI} \times 36 \text{ inches}} = 37.5 \text{ yds/hour}$$

assuming that one operator looks after 8 machines and is paid Rs.4/= per hour.

Labour Cost/yd = Rs. 4.00 = Rs. 0.013

37.5 x 8

Labour cost for 100,000 yds = Rs. 1300/=

Cost of one weaving machine = Rs. 250,000/=

Assuming the life of machine of 5 years working 3 shifts and 200 working days per year.

Cost/machine hour = $\frac{250,000}{200 \times 5 \times 3 \times 8}$ Rs. 10/40

Machine cost per yard = 10.40 300 yds Rs. 0.346

Machine cost per 100,000 yds = 34,666/=

Total (Labour + machine) cost= 1300+Rs.34,668=Rs.35,966/

or say 36,000/=

Total Cost per yard Rs. 036

5.9 For the sake of comparision production cost for 100,000 yards of cloth on the handloom and shuttleless weaving machine are listed below.

Handloom = Rs. 100,000/=

Shuttleless Rs. 36,000/=

5.10 The gap shown by the above figures between the minimum and maximum technologies is somewhat exaggarated as cost of back process, quality of material etc. has not been taken into account. If that is done the gap will narrow down but none-the-less would remain fairly visible.

5.11 The figures in the preceeding paragraph clearly favour Maximum Technology for Sri Lanka. However, if the level of technology and the level of employment is balanced it would probably mean that Sri Lanka should go in for simple power looms with a few automatic stop motions.

5.12 Knitting is an alternative for weaving. With its high production knitting can be and is an alternative to weaving. The field for knitted fabrics, however, is limited and once again the installation of knitting machines will depend upon the level of technology coupled with level of employment envisaged and the quantum of consumer demand.

6. The Textile Industry

6.1 The present textile industry of Sri Lanka, is very inadequate and cannot meet the needs of the local population. As already mentioned the industry is both in the public and private sector, the machinery in the public sector mills ranges from good to obsolete. Private sector

mills are slightly better. A planned programme of balancing, modernisation and replacement of obsolete machinery (BMR) should be taken in hand immediately. Spare parts are either not available at all or are in short supply. Appropriate technology can play a role in this regard in selecting the spare parts which can be manufactured/fabricated locally with advantage. A few small factories producing spares should ultimately spring up, but care should be taken to produce standard, durable parts.

6.2 The present industry, fortunately, is well dispersed. When additional mills are however set up priority should be given to the Mahawali Ganga propect area where some raw cotton will be available locally.

6.3 Blow Room

6.3.1 The opening and cleaning machines have been improved alongwith the spinning machines over the past several decades. From scutcher lap the industry has progressed to chutefeed. There is little appropriate technology, in this sector to choose from.

6.4 Card Room

6.4.1 The choice is between ordinary low production card or the high production card or the tandem card or card fitted with crush rollers. Carefull study of quality and appropriate technology in this section is advocated. If the capacity of an existing mill is being expanded then the

then the modification of the existing cards together with the installation of the crushrolls will mean that the existing cards would be enough to cater to the increased spinning capacity of the mill. This will save considerable foreign exchange. Training of workers and the maintenance staff would be necessary. It is recommended that such a technical training institution for different skills should be set up at once.

6.5 Draw Frame, Comber & Roving Frames:

6.5.1. The choice of appropriate technology is limited. The choice essentially boils down to the choice of speeds, drafting systems and package size. The choice of drafting system, to some extent, would depend upon the choice and quality of raw materials.

6.6. Spinning:

6.6.1 Choice of appropriate technology in this section is quite wide. The choice can be made from small lift to high lift, from low draft to super highdraft, from ordinary to live ring and lastly between ring spinning and open-end spinning.

6.6.2 The choice of appropriate technologywill be dictated by the:-

(a) Level of employment required.

(b) Level of yarn quality required.

(c) Availability of suitable back-process.

(d) Availability of skilled operators and maintenance staff.

(e) Availability of training facilities for the above.

6.6.3. The open-end yarn although slightly inferior to ring spun yarn in strength has less thick and thin places and, therefore, is more suitable for knitting. The O.E yarn sells at a premium but on the other hand the number of workers employed and the power used are much less than required in ring spinning. Moreover, the mechanical properties of the O.E yarn are quite different from ring-spun yarn. The dyeing properties would also be different. However, the comparatively higher unit cost of O.E. machines should be kept in mind.

6.6.4 Itis suggested that an in-depth analysis on the lines presented elsewhere in the paper may be carried out by taking into account the back process, quality level etc. before deciding on the level of appropriate technology and, therefore, level of sophistication of the yarn forming systems.

6.7 Cotton and Man-Made Fibres Blends:

6.7.1 Common man needs a good strong fabric which weld last long, be comfortable, fast in colour, needing minimum care and is cheap. Nylon or polyester fabrics would fill the above requirements but would be uncomfortable in hot and humid climate of Sri Lanka. The choice of appropriate technology in this regard is obviously with blends. The ratio of cotton and polyester blends are fairly stable and 35%-65% or 20%-80% blends are most commonly used. Appropriate technology would be required in processing the blends and more so in the finishing of the blends.

6.8 Hand Looms:

6.8.1 As discussed earlier, conditions in Sri Lanka clearly favour higher degree of technology than involved in hand looms which require long hours and hard toil and , at best, yield a poor return.

6.8.2. As suggested earlier, the hand looms should be replaced with power looms with perhaps weft and warp stop motions. However, a sufficient number of hand looms should be retained for special fabrics for export. Before such a decision is made few questions must be answered, they are:

(a) What is the employment level that is being envisaged?

(b) Is the product in demand outside the country?

(c) Is the level of education and skill of the labour force high enough to warrant a higher technology in form of power looms with few stomotions and with perhaps automatic weft replenishment?

(d) If the level of education of workers is high enough, are facilities for training in the new technology available?

(e) Is the conversion capacity large enough to absorb increased fabric production which will result by the induction of higher appropriate technology.

6.8.3. Reliable production figures for the hand looms sector are not available. It is, however, clear that bulk of the production goes to the local market and hardly 1-5% is contributed to export market in the form of batiks. In depth study would reveal the weaknesses of this sector. Some of them are listed below:

(a) Growth without due attention to future market requirements.

(b) Lack of quality control and difficulties in maintaining any quality level and knowledge of market requirements.

(c) Limited technical knowledge,

(d) Poor financial conditions of the hand loom owners .

6.8.4 Uptil now this sector has been able to survive only because of import restrictions on foreign cloth which resulted in a 'Seller Market'. Under these conditions, the hand loom industry could sell what ever they produced with out regard to quality and price. The situation has recently changed with the liberalization of import of certain categories of piece goods, and,therefore, weaknesses listed above have become more evident. Under free trade the hand-looms will perhaps cease to exist.

6.9: Power Looms:

6.9.1. Replacement of hand looms by power looms will diminish the number of workers employed in the hand loom sector. The total output will increase many fold and subsidiery satellites facilities like werping, sizing, calendering and dyeing would develop with some help from government. This will be all to the good as the days of hand-loom weavers ers really past.

6.9.2. Installation of powerlooms would mean a slightly higher technology and, therefore, the powerloom industry will attract slightly better educated workers who would be more conducive to institute an elementery form of quality control. On the whole, the higher appropriate technology would mean higher production, better quality, lower sale prices and establishment of subsidiery facilities. The drop in employment

caused by the switch to higher appropriate technology would be equalised by creation of additional job opportunities in the subsidiary facilities. The subsidiary industries would by themselves also require a study in appropriate technology. In the end it may mean a sustained chain-reaction of studying and adopting appropriate technology for the whole textile industry.

6.9.3. In order to make the powerloom sector competitive and efficient, following recommendations are made:

(a) A training institute should be established where the operators may receive training inappropriate technology, thus upgrading their skills.

(b) A booklet on how to run and maintain a powerloom should be prepared in Sinhala and Tamil. The booklet should have basic information regarding technology, quality control etc.

(c) A strategy of growth should be planned for power loomindustry. Possibilities of tax incentives should also be considered.

(d) Possibility of buying yarn in bulk should be explored.

(e) Facilities to set up anciliary facilities should be provided.

6.10: <u>Dyeing and Finishing:</u>

6.10.1: In bleaching, dyeing and finishing several options are available. Batch dyeing or continuous bleaching and dyeing can be opted for. Similarly, printing, screen printing, roller printing or transfer printing can be employed.

6.10.2 For Sri Lanka both low technology and higher degree of technology are recommended. For handloom or powerloom production batch-bleaching and dyeing even in cement tanks is recommended, while for mills higher technology is recommended. Transfer printing is becoming popular and surprisingly relatively less skill is needed at a higher level of technology.

6.11 Training and R & D :

6.11.1 Training is essential even at a very low level of technology. In Sri Lanka, it has been established that middle level technicians are needed in large numbers. The University of Sri Lanka, with the help of UNDP/UNESCO, has started a 3 year course of textile technology. The course involves two years' theory and one year of in-plant training. At the end of three years the successful students are awarded National Diploma of Technology (N.D.T).

6.11.2 UNDP/UNESCO has provided fellowships for 36 man-month testing equipment worth U.S.$ 85,000.00 and expertise.

6.11.3 The NDT course is tailored for middle level management. However, industry does need higher technology and hence also higher qualified technologists. The educational system of Sri Lanka is well poised to produce such technologists. It is therefore, recommended that the NDT course should be upgraded to also provide post-NDT teaching facilities. Sri Lanka has a unique position in Third World on account of 85% literacy. Government should cash-in this unique position and provide enhanced facilities for technical education.

6.11.4 R &D is essential for solving day to day technical problems of the industry. The Government of Sri Lanka has indicated its desire to set up a Textile Research and Training Institute. The Institute should not engage in fundamental research but concentrate on 'goal-oriented research'. It should also provide consultancy services to textile industry to raise its productivity and efficiency. A design centre for the textile industry is also recommended. It has been reported that the textile industry of Sri Lanka is currently operating at approximately 40% efficiency. The proposed institute and the Centre can help correct this situation.

6.12: Quality Control:

7 6.12.1 Quality does not mean ever increasing quality, but keeping the quality under control. Quality standards should be established according to local or export demands. Appropriate technology will help in choosing right standards. Routine testing like yarn number , strength and twist should be standardised.

For instance, ordinary U% checking adequate or has it to be advanced where spectrograms are needed?

6.12.2. The Quality Control department should establish various control procedures by which the top management would be able to monitor the working of the various departments of a mill. It should also institute material handling, inventory control, maintenance etc.. All these need a rather high technology and rigorous training. However, each mill will have to determine the level of technology needed.

6.13 Marketing Research:

6.13.1 There are a few organisations in Sri Lanka which look after the interests of textile industry and trade. It is suggested that the proposed Textile Research and Training Institute establish a marketing research department which should:

(a) Locate marketing problems and suggest solutions.

(b) Provide information regarding market trends.

(c) Provide advance information regarding fashion trends.

(d) Advice the industry on Product Development.

(e) Bring about an interaction between the raw cotton producer or importer, user and teaching staff of the Department of Textile Technology, Katubedda Campus.

(f) Provide an effective and reliable, three way information channel between trade and industry, research and education.

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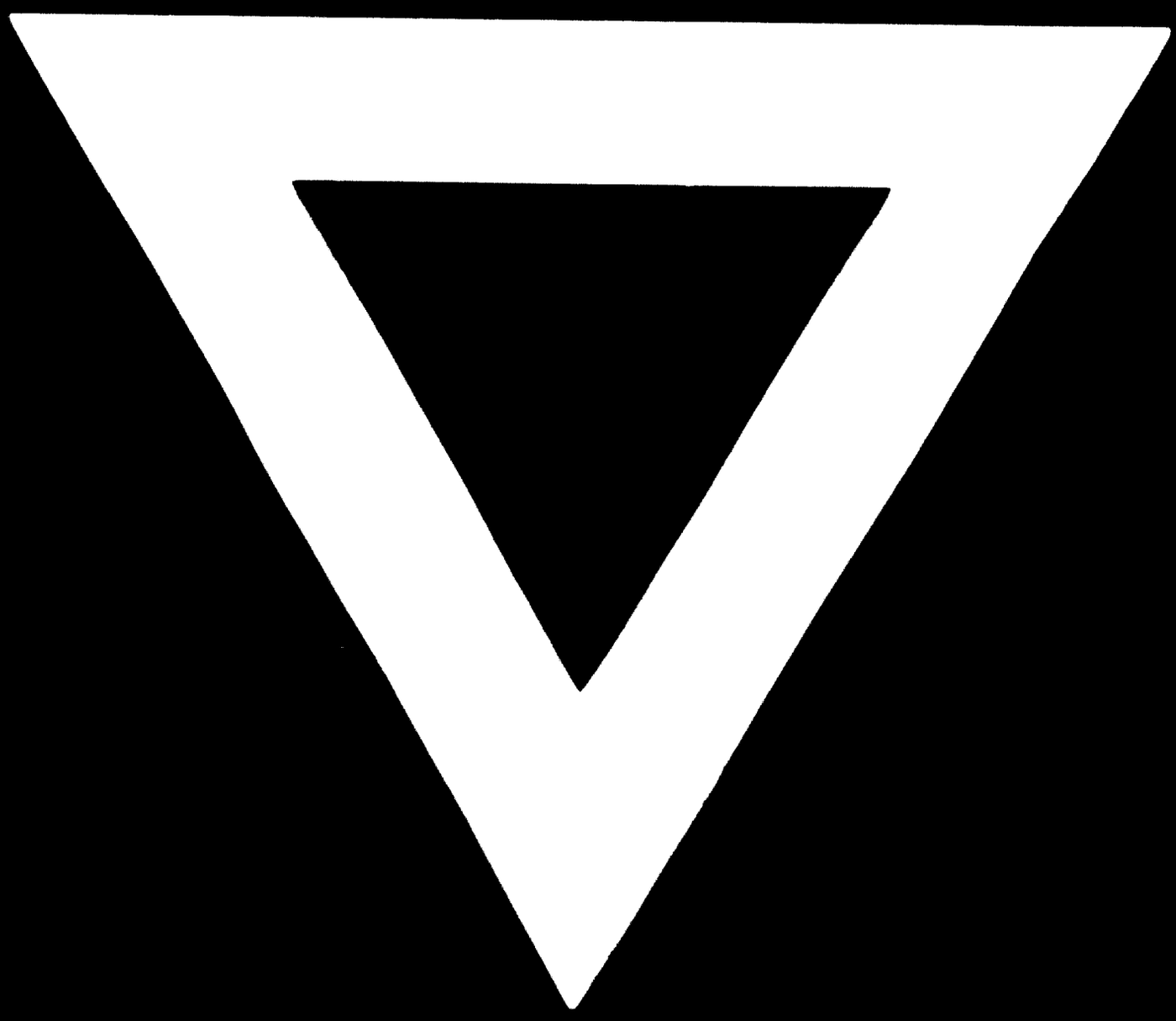

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