# EXECUTIVE SUMMARY

## 1.0 SHUTTLELESS LOOMS - AN INTRODUCTION

1.1 The fundamental principles of weaving are, SHEDDING i.e. dividing the longitudinal threads called 'warp' into two sheets; PICKING i.e. insertion of transverse thread called 'weft' into the space created by the division of warp sheets and BEATING i.e. pulling the inserted wefts one after the other to form cloth. There is no change in these principles whether it is Handloom, Powerloom, Automatic Loom or Shuttleless Loom technology.

1.2 Shuttleless looms have been developed to overcome the inherent problems created by the dynamics of the picking mechanism on the conventional Fly Shuttle Looms and make use of entirely different methods of weft insertion. Air Jet, Water Jet, Rapier, Gripper (Projectile) and Multi-Phase are the various types of Shuttleless Weaving Machines named after the method employed for weft insertion.

1.3 Shuttleless Weaving Machines are generally of wider widths enabling the simultaneous weaving of two or more widths; upto 400/420 cms. in the case of Air Jet and Rapier and upto 540 cms. in case of Gripper. The weft insertion rates achieved are 1560, 1480, 2850 and 2565 Mtrs./Mt. for Gripper, Rapier, Air Jet and Water Jet Weaving Machines respectively.

1.4 Shuttleless Weaving Machines are suitably designed to match the requirements of high insertion rates, shedding, beating and other auxiliary motions. Let-off and take-up mechanisms and weft monitoring are invariably controlled through microprocessors. The machines are equipped with features like automatic pick finding & repairing and weft accumulators.

## 2.0 STRUCTURE AND TECHNOLOGY STATUS OF THE INDIGENOUS INDUSTRY

2.1 Manufacture of Shuttleless Weaving Machines commenced in India only in 1986. The following four companies have been licensed to manufacture these machines.

| Manufacturers | Licensed Capacity-No. of Machines/Year | | |
|---|---|---|---|
| | Air Jet | Rapier | Total |
| Lakshmi Automatic Looms Works Ltd. Hosur (LAL) | 500 | 1100 | 1600 |
| Central India Machines Mfg. Co. Limited Gwalior (CIMMCO) | - | 124 | 124 |
| Harish Textile Engineers, Bombay (HARISH) | 150 | - | 150 |
| Loyal Machine Works Ltd., Coimbatore (LOYAL) | 150 | - | 150 |

The LAL manufactures Air Jet Weaving Machines in collaboration with Sulzer Bros. of Switzerland and Rapier in collaboration with Jean Gusken of Germany. The collaborators of CIMMCO are Lindeuer Dornier of Germany and HARISH has collaboration with Palytechnica of Czechoslovakia (erstwhile). Loyal had developed their Air Jet Machines through indigenous sources.

2.2 LAL, a company belonging to the Lakshmi Group has its plant at Hosur, Tamilnadu and also manufactures High Speed Automatic Looms in collaboration with Ruti of Switzerland. CIMMCO has its plant at Gwalior, Madhya Pradesh and manufactures conventional, ordinary, semi-automatic and automatic looms, winding and warping machines besides Rapier type Shuttleless Weaving Machines. The manufacturing unit of HARISH is at Umbergaon, Gujarat and manufactures cloth processing equipment besides Shuttleless Weaving Machines. LOYAL's manufacturing facilities are at coimbatore and their major products are metal cutting equipment like lathes, shapers etc.

2.3 LAL have an installed capacity to manufacture 500 Air Jet Machines and 200 Rapier Machines per annum. Manufacturing of Air Jet Machines commenced in 1986 and Rapiers in 1990. Till Aug, 91 LAL had manufactured and supplied 273 Air Jet Machines and 23 Rapier Machines. CIMMCO had supplied 400 machines, HARISH about 150 machines and LOYAL about 106 machines.

2.4 The plants of LAL and CIMMCO are well equipped with fairly modern machine shops provided with electro mechanical machine tools, like Milling Centres, Turning Centres, NC and CNC Milling Machines, and Lathes etc., apart from a Heat Treatment shop and Grey Iron Foundry.

## 3.0 INTERNATIONAL SCENARIO

3.1 Projectile Weaving Machines offered are upto 540 cms. width, working at maximum insertion rates of 1560 mtrs/mt with 4 colour pick sequence and with features like automatic pick finding, electronically controlled warp let-off, weft accumulator and feeder, electronically controlled lubrication system and with a choice of tuck-in, leno or fused selvedges. Machine monitoring and controls are aided by microcompressors to improve efficiency, reduce failures, simplify maintenance by adjusting the operational status of the machines during their operation.

3.2 Similarly, Rapier Machines are also available with similar elctronic features. Machine design, material and workmanship have been perfected to make the Rapier a highly versatile machine capable of using the widest range of yarns and weaving all types of fabrics.

3.3 With the development of Air Jet technology, new models are offered with maximum weft insertion rates of 2850 mtrs. per minute not so far achieved on any other system of Shuttleless Weaving Machine, apart from multicolour weft insertion upto 6 colours and unusual electronic features like bidirectional communication with host computer, automatic pick repairing, automatic controls on weft insertion timings, looming robot and automatic cloth doffing.

3.4 Water Jet Machines continue to be offered in comparatively narrow widths upto 230 cms. but with high insertion rates of 2565 mtrs./ mt. maximum. The electronic monitoring and control systems available on other types of Shuttleless Weaving Machines are also available on Water Jet Machines.

3.5 Weft Feeders have contributed in a big way to improve the productivity of sophisticated weaving machines. Feeders available offer precise control of weft tension, matching winding speed to the varying speed of weaving machines, yarn exhaustion and weft breakage detection before the yarn has left the spool.

3.6 Use of electronics on Shuttleless Weaving Machines has not only eased the operation of weavers but has simplified supervision and maintenance and also provided integrated process automation. Shuttleless Weaving Machines installed in a shed can communicate to a centralised data collection and process monitoring system and get feed-back for integrated working to achieve maximum corporate benefit. Systems are available to load fabric designs onto the jacquards equipped on looms, from a central computer store. Looms can be monitored for production scheduling and necessary instructions issued for changes. Production Planning and Control technique can be exercised on the complete weaving shed through such an integrated computerised control system.

3.7 There are about 40 well known manufacturers of Shuttleless Weaving Machines mostly from Europe and Japan. Most of them are offering more than one system. However, Gripper (projectile) System is offered by 4 manufacturers, the most popular of them is Sulzer of Switzerland. The features and speeds offered by the various manufacturers are more or less comparable.

## 4.0 PROSPECTS OF SHUTTLELESS WEAVING IN INDIA

4.1 Shuttleless Weaving Machines installation, wihich is of the order of 17% of the total loom installation in the world, is hardly 1% in India.

4.2 Shuttleless Weaving reduces the cost of production by almost 10% in comparison to high speed automatic Shuttle looms. Besides economy of cost, the quality of cloth obtained is far superior and it is of a quality which is acceptable in the international market.

4.3 The cloth production in the country which was at 17,818 million mtrs. in 1990-91 is projected at 26,800 Mill. Mtrs. by 1994-95. The share of increase in production for the organised mill sector and the power loom sector are reckoned at 1100 Mill. Mtrs. and 2900 Mill. Mtrs. respectively over a period of 5 years. To meet the additional production as well as provide for replacement of aged looms, the demand of Shuttleless Weaving Machines is placed at 2100 looms per annum.

4.4 In 1992, there were about 8000 Shuttleless Weaving Machines installed in over 40 textile mills in the organised sector and a score of power loom units. A survey carried out in the industry reveals that shuttleless weaving technology has been well received and stablised in the user industry. Local mills are installed with cheap Air Jet Weaving Machines of Russian makes, working at WIR of 410 Mtrs./Mt. to Swiss makes working at 1475 Mtrs./Mt., as well as Russian make projectile working at 640 Mtrs./Mt. and Swiss make machines working at 1290 Mtrs./Mt. The Rapiers of different makes work at about 500 to 650 Mtrs./Mt. The wide difference in speeds due to the different years of procurement of these machines by various mills.

## 5.0 TECHNOLOGY GAPS AND THRUST AREAS

5.1 Indigenous Rapier Machines offered are upto 360 cms. width with maximum insertion rates upto 600 mtrs./mt. The corresponding width and speed on international makes are 400 cms. and 850 mtrs./mt.

5.2 Similarly, on indigenous Air Jet Machines, the maximum width

available is 280 cms. as against 400 cms. offered by international makes. The insertion rate of indigenous machines is also low at 1570 mtrs./mt. against 1800 mtrs./mt. available on international makes.

5.3 Automatic Pick Finding, Automatic Pick Repairing, Electronically Controlled Let-off, Take-up, Centralised Lubrication, Bi-directional Communication and Integrated Microprocessor Monitoring and Control are some of the features offered by international Shuttleless Weaving Machine Manufacturers, which are not available on indigenous machines.

## 6.0 RESEARCH AND DEVELOPMENT

6.1 Shuttleless Weaving Machine manufacturers in Europe and Japan have large size units with turnovers ranging from Rs.300 Crores to Rs. 5,500 Crores. The corresponding turnover for local manufacturers is Rs.4 Crores to Rs.24 Crores. International manufacturers spend 4.5 to 6% of the sales turnover on R & D activities. Concerted efforts are made to increase the versatility and productivity of the looms in absolutely reliable conditions. The thrust is on achieving higher speeds, precise control of machines, increased automation and reduction in waste and down-time. The R&D efforts are also aimed at attaining "Total Management System" through electronic monitoring on individual looms by means of feed back instructions and controls.

6.2 The other areas where R&D efforts are being expended are improving engineering design, using new materials to reduce energy requirements and improving production rates. R&D work related to automation of warp and weft repair, introduction of looming robots and cloth doffer have also been taken up. In brief, efforts are to bring about maximum automation and reduce manual intervention to the minimum.

6.3 The R&D efforts by indigenous manufacturers have been directed towards development of machines with comparable quality standards as those of their collaborators Indigenisation efforts by way of development of prototype parts which were largely being imported as well as application development are other areas where efforts have been made.

6.4 A strong R&D base, experienced high level of scientific and technical man-power and substantial investments are essential requisites for promoting indigenous development. The Indian manufacturers do not have these essential requisites. Further, there is no research institute in the country working regularly on R&D of SLWMs. However, ATIRA has developed a prototype

Multiphase Weaving Machine and is now looking for a machinery manufacturer to commercialise it.

6.5 Textile machine design education facilities also need to be strengthened by supporting a post graduate programme covering textile electronics and computers besides mechanical machine designing.

6.6 Due to absence of the necessary infrastructure and organised research and development efforts, the state of indigenous technology of SLWMs manufacture is very much at an infant stage.

6.7 All the indigenous manufacturers have by and large absorbed fully, the level of technology for which they had collaborated.

## 7.0 RECOMMENDATIONS

7.1 India has the largest installed weaving capacity in the world and it needs to fill up the wide technology gap and develop suitable indigenous machines at competitive prices for the modernisation/ expansion of the industry. Allowing deemed export status to equipment suppliers who supply such equipment to units fulfilling export obligation, is recommended.

7.2 Indigenous manufacturers should strengthen their R&D and improve their productive volumes to generate financial resources for undertaking R&D. This would also give impetus to the development of the ancillary industry which is getting discouraged due to insufficient volume of business. Availability of indigenous SLWMs at affordable prices shall also improve the technical health of the textile industry resulting in increase in exports and availability of cheaper and better fabrics in the domestic market as well.

7.3 To augment the educational infrastructure for the textile industry a post graduate R&D oriented programme covering textile electronics and computers besides machine design may be introduced.

7.4 Specific projects, specially in the area of electronics should be identified and undertaken in close co-operation with other premier institutes like CEERI, Pilani in close interaction with NAL, Bangalore for mechanical design considerations.

7.5 A large scale project on the development of indigenous air jet and rapier shuttleless weaving machines may be undertaken by R&D organisations together with the manufacturers. Such a project, once established, can be later expanded and developed to a national level institute working exclusively on textile machinery.