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Editorial

The release of TANTU Annual Journal 2019 on seventh edition of TANTU seminar gives us immense pleasure for being able to present a star-studded panel discussions as well as curated writings from astute academicians and industry alike.

Like the previous couple of years' product focused seminars, this time we are again going to address different issues related to a common, yet classic, never out of fashion product- guess what? Yes, you your guess is right if **"It is in Your Jeans"**. On contemporary ground, as sustainability and circularity continues to be the flavour of discussion in textile and apparel fraternity, denim and jeans are coming back stronger due to its severity of water and energy consumption. Jeans is always in the news for good or bad- an interesting garment which is classic yet fashionable; blue yet can take any colour. Globally, consumers own an average of 5.4 pairs of blue jeans. It would be natural to expect that the United States would boast the highest per capita ownership with around 8, given its seasonal temperatures and the fact that it is the birthplace of blue jeans. While surprisingly India is far behind with per capita ownership of 0.3 having been one of the leading exporters and boasting a colossal population of young people which could be exploited as immensely potential market. For this product's huge impact on both global apparel business and environment, numerous seminars and conferences are being organised to discuss the issue of energy consumption, water usage, CO2 footprint and effluent discharge per pair of Jeans making. So, we also have decided to explore the nexus among technicality, art of manufacturing of jeans, its impact on environment and business aspects during our 7th seminar through three panel discussions where industry experts will share their knowledge and experience on **"Denim Fabric Development: Art or Science", "Jeans Finishing: Environmental Reboot"** and **"Start-up in Blue Space"**.

In addition to that, this year TANTU annual journal 2019 would include five write ups from TANTU alumni members on varied topics but all followed the seminar theme Denim and Jeans. The denim manufacturing spinning to finishing, sewing machine technology for jeans making, laser finishing of denim and business potential in the denim industry. The journal has also covered technical write-up from industry experts on various topics like – cutting room automation, latest jeans finishing machinery, software solutions for the textile and fashion industry.

We could not be happier to announce that, this is the second year in row, we are sponsoring two students each from both Berhampore and Serampore College in West Bengal to participate TANTU seminar under **TANTU Young Engineer Scholarship Program**. The objective of this scholarship program is to create an eco-system for the students to have a fair exposure on industry and capacity building. The initiative will also facilitate the students to interact with the professionals of diverse areas and acquire knowledge on the latest developments, innovations and employment opportunities during the event.

On behalf of the entire team of TANTU, we would like to extend my heartfelt thanks to all those who financially and otherwise supported in our efforts to bring together like minded professionals, nurture young minds and keeping this industry alive and relevant. Last but not the least the inspiration and support of our spouses and children notwithstanding the agony and tolerance for all the late comings and meetings.

PRASANTA SARKAR, Editor
ADITYA MAHAPATRA, Assistant Editor www.tantutextile.com

DENIM AN EYEFUL INDUSTRY- EXPLORE THE POTENTIAL

CHANDAN SAHA

GENESIS OF DENIM

Genesis of denim is quite diverse. Denim, the unique featured apparel is popular among diverse segments of users across the globe since innovation of the product. It had been transformed to the present phase through various innovations to make it user friendly. The 'DENIM' nomenclature is generic in nature as it encompasses both 'Cloth' (fabric) and 'Clothing' (apparel). Manufacturing of Denim was originated as sturdy apparel in a small way in France to keep the Sailors, Miners and Cowboys in a comfort zone after wearing such garments. Denim has an unusual history of few hundred years. Originally it was a strong & sturdy material made from wool. By the year 1700, it was made of wool & cotton. It was used to make sails. Later some Genoverse sailors eventually felt to make an innovation and thought it fit for making great pants or 'Genes'. Denim was treated with blue dye obtained from Indigo plant. Indigo was used as dye since 2500B.C. in diverse countries like Asia, Egypt, Greece, Rome, Britain and Peru etc. mostly imported from India as the plants were only available in India. The nomenclature was originated from the word 'Serge De Nim', it indicates that 'NIM' means Blue lagoon, De comes from French language. Indigo, a natural dye, originated from India was matching with blue lagoon, hence; Indigo was started using as colorant to manufacture denim. The synthetic indigo was invented in the nineteenth century and it was found cheaper & better quality product to use to improve fastness properties & aesthetics and had replaced the natural indigo.

The blue Jeans made of Denim cloth first got visible in the present status in mid of nineteenth century. Levi Strauss, an immigrant enterprising mind first thought of innovating a sturdy pant for the miners working in California. He designed the product and branded it in the style & name of 'Levis' in 1850 and launched in the market. The design was remained unchanged with a minor modification by attaching a few accessories. Later on an Italian tailor, Jacob Davis invented the Riveted pant on the request of miners. Davis subsequently, granted Strauss to adopt the idea of Rivet pant and it was patented in May, 1873. A few other modifications were also made in 1920. The product was still not on the line of user friendly, so there was a need to make it user friendly. In 1937, Rivets on the back pockets were pushed inside as it was damaging the items once got in touch. The complains were flowing from school board and cow boys for damaging chairs and saddle respectively. It is reported that the innovative product became very popular since 1950 across the globe and it got a visibility

Chandan Saha

in India since early '70s. A few manufacturers in Mumbai (then Bombay) started manufacturing the items by adopting the technology partially and using Indigo & other dye and launched in the domestic market as 'Denim' and Jeans. Denim was usually available in blue but Jeans were of various colors like Meroon, Yellow Black and Blue etc. The product became very popular late70's as it was affordable to middle income group consumers and Indigo Denim was popular among high end consumers as it was expensive. In the last two decades, a big no. of units have been established in India and made a presence as the second largest denim manufacturers and also a leading exporter of denim clothes in the world.

INDUSTRY AT A GLANCE ACROSS THE GLOBE VIS A VIS IN INDIA

Denim industry was initiated in Europe and became popular in the USA. It had been used since the middle of the nineteenth century but gained popularity since 1873. At present China is

the largest producer of Denim fabric followed by India. Other Asian countries also made their presence in manufacturing denim in the world market. Bangladesh also became a leading manufacturing country of denim. So far both India and China are playing a lead role in manufacturing & exporting denim fabrics to different countries. Both Bangladesh & Turkey also play an important role in manufacturing and exporting denim to EU and USA. It reveals that there are more than 500 units of manufacturing Denim across the globe.

There are 31 units in Bangladesh, 13 units in Pakistan and 9 units (as reported) in Turkey. It reveals that China has a major share of denim fabric manufacturing in the world. It contributes more than 50% of total production whereas India is the second largest producer having a share of 10% and Pakistan & Bangladesh are having a share only 5%, & 2% respectively. Worldwide Denim manufacturing units have adopted modern technology to manufacture various featured denim fabrics like, Marble denim, Crushed denim, Reverse denim, Bubblegum denim, Colored denim, Denim from fox hair, Ecru denim and Vintage denim. There were good attempts to reduce water & energy consumption by adopting appropriate technology to reduce cost. It is reported that 7600 lts. of water is usually used to produce a pair of denim jeans; of course water recycling system is inbuilt in technology to recycle and reuse it.

Denim fabric manufacturing industry is considered a sunrise industry in the entire textile value chain of India. The industry has been registering an exponential growth of 15% over the last decade. The industry took a root in India since '86 and since then growing immensely to meet both domestic & overseas market. It is stated that there were 32 fabric manufacturing units having capacities between 10 MMPA to 110 MMPA till 2012 and that has gone up to 47 in 2016. The production capacity was 800 Mn. Mts in 2012 and scaled up to 1500 Mn. Mts. in 2016. Another few units are in the pipeline to start production in the next couple of years and is expected to reach around 2.0 bn. mts. The industry strikes a business turnover of Rs.1500 crores and expected to grow more by next couple of years. The industry provides direct employment of four lakhs people besides indirect employment. It is stated that current consumption of denim fabrics is only 700-800 Mn. Mts. growing at an annual rate of 12%. At present domestic consumption is only 50-60% of total production. India's denim industry has 10% of the share of Global denim industry but has mere share of 2.5% of global trade. Hence; both domestic consumption and export of value added product have to be scaled up to enhance global market share as well utilizing the capacity in full. At present, Ahmadabad city is known as Denim manufacturing hub of India and Arvind Mill is the largest producer of denim.

TABLE-1

DENIM FABRICS MANUFACTURING UNITS ACROSS THE GLOBE.

Sl.No.	Region/Country	No. of Units.
1	China	297
2	India	47*
3	Asia (excluding China & India)	81
4	North America	9
5	Europe	41
6	Latin America	46
7	Africa	15
8	Australia	1
	Total	537

*Source: Denim Wikipedia Nov.2018 & Textile MagazineJan'18**

Table-2

Production share of various countries.

SL. No.	Name of the countries	Share in %
1	China	52
2	India & Pakistan	15
3	Mexico & Brazil	13
4	EU, Turkey & Middle East	7
5	USA & Canada	4
6	Rest of the world	9

Source: Global Denim producing countries document, Nov'29,2018.

GLOBAL & DOMESTIC MARKET SCENARIO OF DENIM

Denim, the unique product, first made a dent in USA market in mid of nineteenth century and gained popularity in 1873. The original product design was redesigned to keep the users in comfort zone. It is reported that blue jeans was getting popular to youngsters in 1950 and 150

Table-3		
Leading exporting countries of Denim fabric worldwide in 2018		
Sl. no.	Name of the countries	Value (in US $ Mn.)
1.	Pakistan	578.5
2.	India	403.93
3.	China, HongKong SAR	367.45
4.	USA	156.62
5.	Italy	145.77
6.	Egypt	117.62
7.	Japan	93.88
8.	Mexico	92.86
9.	Thailand	77.58
10.	Germany	27.99
11.	Turkey	338.0*

*Source: Leading Exporters of world statistics, May'19 & other sources**

Table-4		
Per Capita ownership of Denim products.		
Sl. no.	Name of the Countries	no. of denim products.
1.	USA	14.8
2.	Colombia	18
3.	Brazil	12.1
4.	Thailand	10.3
5.	Europe	7.3
6.	China	5.7
7.	Japan	4.9
8.	India	4.6
9.	Mexico	12

Source: CCI - Global lifestyle Monitor survey'16. & another source.

pairs were sold in 1957 worldwide. The growing trend continued till 1981. Denim became very popular, especially in the USA and later on in Europe. 200 Mn. Pairs were sold in1967, 500Mn. Pairs were sold in 1977 and 500Mn. Pairs were sold in at the peak in 1981. The size of the world denim market was estimated to be US$ 51.6bn. with a growth rate of 5% in 2007 and it is expected to grow at a CAGR of 6.5% in the next couple of years and estimated to reach US$ 153bn. from US$113bn in 2015. At present, denim products are preferred by consumers of developed, developing and under developing countries across the globe due it's durability, easy wash & wear and cost economic. The global market share is dominated by North America (39%), followed by Japan & Korea (10%), Western Europe (20%) and rest of the world (31%) etc. It is also reported that demand growth of denim market in next couple of years is expected to largely emanate from Asia-12%, Latin America-15%, North America-10%, Europe-4% and Mexico & China will also experience a growth. At present a good no. of countries are exporting denim fabrics to USA, Europe, Cambodia, Vietnam, Sri Lanka, Bangladesh and other African countries.

Globally denim manufacturing Asian countries are the leaders in denim fabric export. As per the information available, India is the second largest exporter of denim fabrics, Pakistan stands first as the leader of exporters, China, HongKong SAR is the third largest exporter followed by Turkey stands as fourth largest exporter for the year 2018. It is reported that India at present exports denim products to 97 countries. Bangladesh major export is to USA and EU.

Today, USA is the leading consumer of Denim products followed by Europe. It reveals that 450Mn. Pairs of jeans are sold in USA every year and 70Mn. Pairs are sold in UK every year. A poll by Shopmart revealed that 25% of American men own 10 or more pairs of jeans and women owns average 7 pairs of jeans in wardrobe average women wear four jeans on regular basis. It is experienced that denim products are very popular among all segments of consumers in African countries and ownership of denim in African countries may be more than many countries but consumers of various segments usually buy products from secondary market. Similarly, youngsters of Latin American countries keep a high preference for denim.

The market size of Indian denim wear was estimated to be Rs.20025 crores in 2016 and estimated at Rs.23076 crores in 2017. The market is projected to grow at a CAGR of 14.5% and reach Rs.39651 crores by 2021.

The Denim wear is projected grow at a robust rate 12.7% CAGR to reach Rs.41947 crores by 2022 and it is projected to grow at a robust rate12.7% CAGR at Rs.76258 crores by 2027. The men's segment comprises of 84% of the market while women

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segment share is confined to 10% followed by Kid's share is only 6%. It is felt that women's segment will grow much faster than men in the next couple of years as it's easy to wear and afford. It is reported that consumers of top 10 cities consume mostly 50% of total denim consumption in the country.

The population of these cities is hardly 10% of the total population. It is experienced that there will be a substantial growth in demand of denim in Tier-II & Tier-III cities in the next couple of years. At present, products are mostly sold of unbranded products sourced from mostly unorganized sector. These products are little bit price friendly and fashioned.

EXPLORE THE POTENTIAL OF DENIM INDUSTRY

Both emerging market scenario and market survey report indicate that there is still room to grow the denim wear market in India as at present only 10% of the total population in ten important cities consumes the major denim products and market is still quite vibrant to absorb the products substantially. Survey indicates that Per capita consumption of Denim wear is still very low and there is enough space to upscale the consumption of denim wear in the domestic market. It reveals that Asia pacific countries will be the leader of future denim market. At present major consumption is experienced only by men's segment and consumption pattern of women & kid's segments is very poor. With the passage of time, lifestyle gets changed dramatically and consumption pattern also moves with a new ethos. There is a substantial scope to expand denim wear market in Tier II & Tier III cities.

Table-5

PREFERENCE OF DENIM BY POPULATION IN VARIOUS COUNTRIES.

Sl. no.	Name of the Countries.	Percentage of population
1.	Europe	71
2.	Latin America	71
3.	USA	70
4.	China	58
5.	Japan	57
6.	India	32
7.	Colombia	79
8.	Mexico	70

Source: Survey Report Meenakshi Kumar, March 2016. & CCI-Global Life Style Monitor Survey'16.

Table-6

PER CAPITA CONSUMPTION OF DENIM PRODUCTS

Sl. no.	Name of the countries.	Per capita Consumption (in pairs)
1	USA	9
2	UK	8
3	Brazil	7
4	Thailand	7
5	China	2
6	India	0.3
7	Japan	6

Source: NCM, Nov'18.

Table-7

LABOUR COST IN VARIOUS COUNTRIES ACROSS THE GLOBE

Sl. No.	Name of the country	Labour Cost per month (in US$)
1	Ethiopia	50
2	Kenya	140-160
3	Bangladesh	101
4	Vietnam	216
5	China	470
6	Cambodia	170
7	Uganda	60
8	Egypt	113
9	India	257
10	Myanmar	135
11	Pakistan	248
12	Sri Lanka	148

Source: NCM'18 & JETRO Survey, 2017-18.

Market survey indicates that a very small percentage of the population keep preference of denim in comparison to developed countries. So, it's important to make strategic plan to expand the market and improve outreach.

It is reported that Ethiopia is an important hub of manufacturing denim wears mainly to cater the needs of internationally established brand for onward export to developed countries. Bangladesh is also

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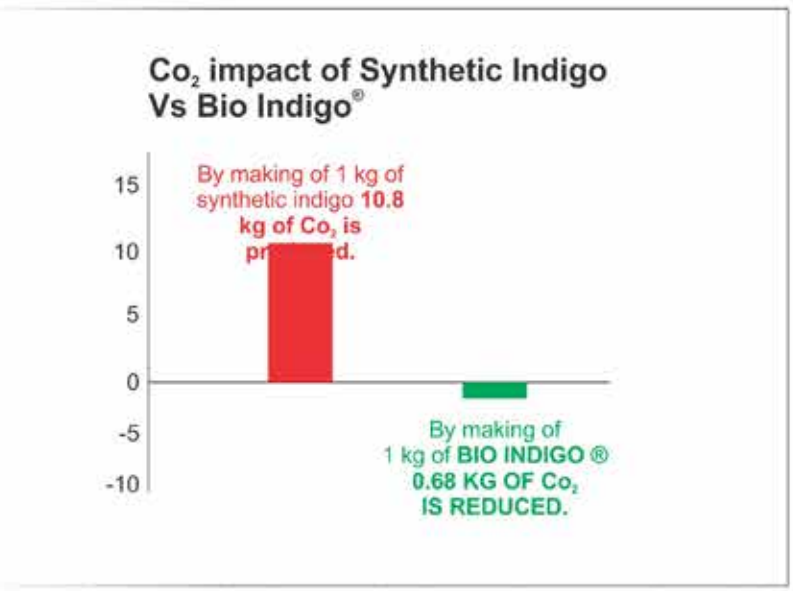

Ref: LCA study of making 1Kg of synthetic indigo Vs 1 Kg of Bio Indigo®

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a manufacturer denim fabric and denim wear and major export to USA and EU countries. Other important countries like Sri Lanka, Vietnam, Cambodia and very recent inclusion of Myanmar slowly becoming the hub of manufacturing denim wear and export to various countries as labour cost is very low in comparison to India. These countries are sourcing the fabrics mainly from India and China, as none of these countries is engaged in manufacturing denim fabrics.

Bangladesh also sources denim fabrics to fulfil the export commitment. It is reported that manufacturing cost denim fabric in India is still cheaper than China but among Asian countries, Bangladesh is quite cheapest. Manufacturing cost of denim wear is in the range of Rs. 250 and Rs. 700-800/- in India but it is marketed in retail nearly 3-4 times of cost, which is absolutely unusual. The cost cutting edge at different stages needs to be well addressed to enlarge the marketing areas and consumer base. Besides, labour cost is still quite competitive in comparison to many countries based on economic strength. India may have to make a strategic plan to export fabrics in more quantity to those countries producing denim wear sourcing fabric from other countries and also upscale the manufacturing facilities of denim wear. No doubt, India has to set a firm plan to improve aesthetics of denim and surface finish to cater the needs of high end consumers and at the same time cost between manufacturing and retailing has to be trimmed to articulate more consumers and improve outreach beyond the ten important cities.

At present we have a good standard of ownership in context to our economy, but per capita consumption is very poor. It is reported that 92% of marketable denim products come from unorganized sector with no brand image and only 8% of products are marketed as branded. It reveals that a major segment of consumers only buy products from secondary market due to low price, that can be brought under mainstream marketing by adopting appropriate strategies and this will boost the actual consumption growth and manufacturers will also get themselves well placed to tap the potential full assessing the market. As market is experiencing a slowdown move, so Govt. has to lay emphasis to encourage the sector to tap huge potential across the global market. Govt. may also devise suitable plan in consultation with all stakeholders to give a stimulus to boost export, till it is getting stable.

Conclusion

The denim industry has been considered as a sunrise industry of textiles in last one and half decade as it has been contributing 35% of forex earning of textile export and projected to enhance the share to 50% by 2020. At present, India's share in global market is substantially low though India is a leading producer of denim fabrics.

There are enough opportunities to grab the potential in various developed countries who are the leading consumers but not big producers. Hence, it's dire need to scale up the upstream facility to convert fabric to value added product and frame strategic plan to export the denim products to those countries where the majority of the population prefer to wear denim.

Besides, it is essential to bridge the huge gap in retail price and factory manufacturing cost to improve outreach the customers. Indian industry should also make firm initiative to adopt modern technology to minimize consumption of water and energy. We are already experiencing an alarming situation of ground water storage, hence; adoption of appropriate technology would be a favourable proposition to address the issue. This may also give an edge over other countries in terms of cost cutting, quality improvement and also building competitiveness to tap the potential full. Govt. should also come forward to extend support formulating appropriate policy & schemes, specially designed to encourage denim industry to tap the full potential across the globe.

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Chandan Saha is a BSc. Tech(Textile) and holds M.Text(Engg.) in System Management.. He is a Chartered Engineer and Qualified ISO Lead Assessor. He was recipient of prestigious Er. Sadanand Memorial Award. He has served a total 38 years in Industry, Research Institutes, Ministry of MSME & NITI AYOG in Govt. of India and has been attached with various professional and academic institutions at various capacities for more than 30years. He made a significant contribution in industry promotion, product innovation, skill development and adoption & practicing modern management tool in MSMEs etc.

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DENIM MANUFACTURING: SPINNING TO FINISHING

DR AMAL CHOWDHURY

INTRODUCTION

Denim is one of the oldest types of work cloths that are available in the fashion world. Some historians believe that it was first worn by sailors of Portugal. Initially it was worn by mechanics and miners. In the 21st century, denim comes in many different styles including carpenters, sportswear, khakis, chinos and combat [1]. Traditionally Blue Denim is warp faced cotton fabric with 3/1 twill construction with warp being dyed in a solid colour and weft left un-dyed [1 - 3]. So, technically speaking, denim is a warp faced twill weave fabric. As coarse yarn count is used to manufacture denim, it is heavy fabric. Apart from traditional uses, today's denim is finding its way into home fashion, being used in upholstery, decorative pillows, comforters, window treatments, slipcovers for furniture or even the tabletop. There are various types of denim, namely, traditional denim, Dry denim [4], Raw Denim, Selvage Denim [1, 5], Stretch Denim, Poly-Denim, Ramie-Denim [4, 5] Color denim, Reverse denim, Vintage denim, Ecro denim, Marble denim, Crushed denim [1] etc.

To cater to the need of different sectors, one should have comprehensive knowledge from spinning to finishing to impart the desired characteristics on the denim fabric. With the right selection of fibre, journey of manufacturing of denim involves various operations which start from spinning followed by dyeing, sizing, warping, weaving & finishing. This paper focuses on these different operations, highlighting their contribution/ importance to enhance the desired attributes of denim.

Dr. Amal Chowdhury

SPINNING

Yarns destined to manufacture denim should have certain desirable characteristics - thicker yarn with bigger diameter, less hairy with less twist - which imparts, softness, ability for better absorption of dye and improved resistance to abrasion of the fabric [6]. Additionally, to impart fancy effect to denim, slub yarn, multicounty yarns are also used. Sometimes, ply yarns, filament yarns, lycra core yarn etc. are used for producing variety of fabrics and to achieve some special effect, comfort in fabric, smoothness, high luster for aesthetic properties. Unlike the weft, the production of warp yarn needs special attention as it can influence the final quality of denim.

There are diverse spinning technologies used for the production of denim such as Ring spinning, Twillo spinning, Open end spinning e.g. Rotor spinning, Friction spinning, etc. Of these, open-end spinning are commercially used for the production of denim yarns [4, 7].

Though open end yarns possess less strength and higher rigidity as against ring yarn, the former has been enjoying mass market denim products due to its lower cost along with other advantages of being resistant to abrasion and snarling [6]. To obtain ring-like effects, mock-ring yarns can be made on open end spinning system by the various devices available (Amsler, Caipo etc.). But some manufacturers recommend using ring spun yarn at least in the warp for aesthetic reasons [8]. A combination of ring spun and rotor spun yarns can help to reduce fabric costs while still maintaining some favourable ring spun fabric characteristics [6]. When it comes to stretch denim, core-spun elastic yarns for weft are predominantly spun on ring frame [8, 9].

DYEING

Indigo, which is otherwise a low quality vat dye, is widely used in denim dyeing, as it gives the characteristic blue colour to denim [6]. While the low fastness

of the dye is a boon for achieving a distressed look, it leads to major effluent problems during the dyeing process. The major issues in dyeing are the reducing agents and the huge volume of effluents, and quality control which involves the monitoring of dye bath parameters like pH, concentration of sodium hydrosulphite and leuco indigo, and the temperature of the dye bath. The pH is of crucial importance, as it controls the level of ring dyeing, and other important factors are the immersion time and number of dips. Indigo dyeing set-up is totally different from others. Generally, there are two most popular methods of dyeing denim fabric [3]. They are Rope Dyeing and Sheet Dyeing.

Rope Dyeing: The rope dyeing technique allows for the simultaneous production of more than one warp set in one run. This maximizes continuity of shades and minimizes the danger of side-centre-side shade variation. This dyeing technique necessitates a ball warper. In this machine around 400 ends are merged and made into rope. Once the process of ball warping is complete, the desired numbers of balls are mounted on the dye range creel. Each rope is run through indigo dyeing process. At the exit end of the dye range, each dyed rope is coiled into a can, which are taken to a long chain beaming process. At this stage randomization of cans is executed to avoid side-centre-side shade variation. It is suited for high production mills since multiple warps can be dyed side by side.

Sheet Dyeing: This process eliminates a few intermediate processes of the rope dyeing. The yarn sheet is washed with chemicals such as caustic and washing soda. After squeezing the excess water, the yarn sheet is allowed to pass through dyeing troughs for oxidation and development of dye on yarn. The affinity of indigo dye to cotton yarn and its build-up property is very low. Hence, the colour depth of indigo colour cannot be achieved solely by increasing the indigo dye concentration. Repeated dips, followed by oxidation, are used to build up the shade. After dyeing, the dyed yarn is washed again with fresh water for two-three times and finally squeezed before allowing it to pass through drying cylinders.

Non-indigo Dyes: Non-indigo dyes, such as sulphur dyes, are now widely used in denim warp dyeing, and they offer vivid colours and a better ecological alternative to conventional indigo dyeing. Sulphur dyes are widely used for bottoming and topping of indigo for reducing the overall cost [6]. Due to their better affinity for cotton, this dyeing is more efficient, and modern techniques can further reduce water usage considerably. Dyeing equipment, originally meant only for indigo, is undergoing transformation to provide the conditions required for the application of other dyes. Nowadays, the proportion of 100% indigo dyed denim warp is very small, as it is commonly combined with other types of dyes in the same application process or overdyed with them.

Overdyeing and Coating: Another common way to spice up the look of a fabric is adding a colour or a coat to it. In overdyeing, the fabric is run through a bath of dye, which is then fixed by a steamer. A popular kind of overdye for denim is black sulfur on top of a warp-dyed indigo denim. On the other hand, coatings are used to get a leathery look and feel. There are two types of coating methods. In knife coating, the coating material is deposited on the surface of the fabric and then the excess is scraped off with a blade. In foam coating, the coating material is turned into foam and then sprayed onto the fabric. For both methods, once applied, the coating is fixed with heat.

DIGITAL PRINTING

Digital printing can be considered as an environmentally friendly technique for denim coloration, mainly because of the low quantity of colorant applied on the fabric, with less use of water and energy. It can also be applied in small lots, and a variety of designs can be created digitally on jeans [6]. Similarly, laser engraving methods have several environmental advantages over chemical or dry washing techniques. So it is clear that digital printing and engraving present ecological and cost effective alternatives to conventional colouration and washing techniques. More interestingly, digital printing provides the designers with more artistic freedom to creatively broaden their ideas.

WEAVING

Weaving is very important in determining the quality of the final garment. Denim fabric is woven as 3/1 twill by the interlacement of indigo dyed warp and grey weft, and the yarn counts influence the fabric properties such as weight, fabric tightness, cover, drape, tensile strength and other properties [6]. The weaving looms often used for denim are projectile, rapier and air jet looms. The denim fabric is manufactured in a different range of weights ranging from 6.5 to 15.25 oz/sq yard [10]. Although classical denim is a 3/1 twill weave, a variety of denim fabrics are manufactured with 2/1 twill, broken twill, reverse twill, zig-zag twill etc. In indigo denim, many drawbacks related to weaving, such as missing end, floats, double end, starting mark, slack end, broken picks, double pick, temple mark, bad

selvedge etc. create prominent defects even in finished and washed fabrics. Maintaining the loom and all the accessories and keeping the stop motion in proper working condition are some of the measures for reducing fabric defects. Proper humidification plant should be designed for efficient removal of indigo dust, fluff, lint which is liberated during weaving.

KNITTING

Denim effect on knitted fabric can be made from three types of technologies. They are float plated technology, Thread fierce, Interlock plated Jacquard [11]. The structure using knit and float stitch, uses knit cams as well as sinkers to knit on one side of fabric and a very tight float on the other where the float gives the woven effect. Depending on the cylinder cam arrangement, the machine generates the ability to do one, two, three needle floats. Knit denim and tuck denim can be produced in a single jersey circular knitting machine with lycra attachment. The fabric produced is passed through a stenter and compactor in order to heat set the fabric as well as the lycra.

FINISHING

Denims are generally sold in one of the four states: loom state, preshrunk, permanent press finished or resin treated. Progressive shrinkage is a common problem with garments manufactured from denims, particularly for heavy weight fabrics, which may be attributed to excessive swelling of yarns during washing. Unfinished denim shrinks [12] as much as 14%. Sanforization and skewing are the two crucial functional fabrics finishes as it controls dimensions. Pre-shrinking, also known as 'sanforization,' solves a fundamental problem of unfinished denim. It eliminates shrinkage. It is suggested to go for two stage shrinkage because if all the shrinkage is removed at one point, during subsequent handling fabric will creep out by 1- 2%. This is minimized by removing the shrinkage in two stages.

Sanforization: It is a mechanical compaction process for woven fabrics. The fabric is fed in between two hot roll bars on top of a stretchy endless rubber belt. The fabric is first moistened, usually by steam. This lubricates the fibres and assists in shrinking. As the rubber returns to its original length once through the cylinders, the warp yarns shrink and the filling yarns are packed closer together. After the fabric leaves the rubber belt, it enters a dryer, which locks the fibres in their shrunken state.

Pre-Skewing: It's not only in length and width that the dimensions of unfinished denim change. They also change diagonally. Once unfinished denim is washed and shrinks, it naturally skews in the direction of the twill line. The diagonal skew causes the infamous leg twist, which becomes progressively more noticeable when fabric is washed as the yarns relax. To avoid it, the edge in the direction of twill is advanced with respect to its opposite edge by at least 30% of the width of the fabric. This skew is maintained through all subsequent finishing steps and eliminates leg torque problem. The weight, twill weave, yarn size and yarn twist determine how much skewing is needed.

Heat Setting: To make stretch denim, a synthetic elastomer that's spun into the yarn and it is used as weft. For stretch denim, heat setting controls stretch ability. To control how much stretch the fabric has, and its crosswise shrinkage, heat setting is needed. The longer the denim is exposed to the heat, the less it will stretch.

Mercerization: Unfinished denim has a rough characteristic and uneven hand feel. Mercerization makes the denim more lustrous. In mercerization, the fabric is treated under tension with a concentrated solution of caustic soda. The finish penetrates the fibres and gives them a rounder shape, which makes the surface of the fabric smoother and increases the fabric's luster or shine. The finish is also used to prepare fabrics for further processing like overdyeing and coating, as it also enables the fibres to absorb more dye. For denim where mercerization gives a look that is too flat and lustrous, the flat finish known as caustification is used. It is some sort of in-between mercerized and unfinished denim.

Functional Finish: Apart from such processes for achieving special fashion effects, several functional finishes can also be applied on denim garments for providing technical and functional properties. Microencapsulation, plasma techniques and nanotechnology are offering different possibilities that were not possible to achieve with normal finishing chemicals [6]. It is reported that nano titanium dioxide has been applied on denim fabrics for imparting multifunctional finishes for value addition

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adopting three routes - dry exhaust, microencapsulation and nano encapsulation [13].

WASHING

Denim is actually a stiff and dull blue fabric without any fashion appeal, and washing is the revolutionary process that has changed this mundane image of denim and thus is now an indispensable process for producing fashion items for leisure wear [6]. The cotton yarn dyed with indigo has a ring dyeing effect. The ring dyed effect means that only the outside ring of the yarn cross-section is dyed. Indigo dye is layered onto the outside of the yarn and the inside fibre is left undyed or white. Due to undyed inner portion, denim shows a unique characteristic as a result of washing. The wash out effect is achieved by removing dyestuff from fabric to get popular abraded, worn out look during washing process. Wash can be divided into two types, such as Chemical wash and Dry wash.

Chemical wash Every small step in chemical washing makes a big difference because indigo dye has very poor wet & dry rubbing fastness [14]. All parameters - pH, M: L: R & RPM of machine - are critical to maintain for repetitive results [2]. Chemical wash contains acid wash, enzyme wash, bleaching wash etc. which are discussed below.

Stone Wash: Stone wash is done to bring "Used effect" or "Vintage effect" on the denim garments. Pumice stones are the key elements of stone washing. During stone washing process, these stones scrap off dye particles from the surface of the yarn of the denim fabric which shows a faded, worn out and brilliance effect [15].

Acid Wash: In this process, pumice stone or rubber ball is used with bleaching agent such as sodium hypochlorite (5 – 10%) or KMnO4 (3 – 6%). Localised effect results in a non-uniform sharp blue/white contrast.

Enzyme Wash: Enzymes, also known as bio-catalyst, are proteins which will attack a specific molecular group, catalyzing specific chemical reaction. Enzymes are ecofriendly as they are biodegradable [16]. The reaction of enzyme can be easily controlled. They are very sensitive to the parameters in washing cycle e.g. pH, Temperature & time.

Potassium Permanganate Spray (P.P Spray): Potassium permanganate spray is done on jeans to take a bright effect on sand blast area. Potassium permanganate solution is sprayed on blasted area of jeans garment with the help of normal spray gun [17].

Bleaching: The dark blue shade is decolorized by the bleaching chemical which destroys the indigo dye molecules [1]. The bleaching effect is done by using an oxidative bleaching agent eg. Hydrogen Peroxide, Sodium Hypochlorite, Calcium Hypochlorite or Potassium Permanganate with or without stone addition. Potassium Permanganate is also used on 100% sulphur black denim fabric. On the other hand, hydrogen peroxide is used when very less color loss is required or if fabric is sulphur top.

Reduced Water Washing: It is high time for the denim garment washing industry to show that it cares for the environment and its operators. Thus there is a radical transformation taking place in this industry from an artisanal, labour intensive industry towards a knowledge based industry, caring for both the operators and the environment. New techniques like laser, ozone, etc. which use a much smaller quantity of water, are now changing the environmental profile of the whole washing process. The integration of such technologies into the conventional washing lines will ensure vintage looks and other fashion effects can be created on jeans with much less water. In such cases, the effluent output is reduced to a negligible quantity, thus transforming denim washing to an environmentally friendly process.

Dry wash It is well known that denim garment washing depends largely on the use of chemicals and stones for achieving the softening and colour fading effects. In this context, the denim washing industry is striving to develop environmentally friendly washing techniques that can result in zero effluent discharge. Dry treatments or nearly water free treatments are slowly becoming a sustainable trend for replacing traditional wet treatments in denim garment washing [6]. Some of the dry washing techniques are mentioned below.

Sand Blasting: Sand blasting is the process of scrubbing off the garment by blowing high-speed air mixed with very fine particles of sand [17]. When the surface area of the garment is blasted, the effect appearing is very similar to the worn-out jeans.

Whiskering: The idea of whiskers is taken from the worn-out lines and impression patterns

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generated by natural wearing on hips and front thigh area. On old jeans, a number of patterns can be observed depending on body shape of user or sitting posture. This method is famous for high quality and cost effectiveness.

Laser Technology: The most recent development in the processing of denim has been the use of laser technology to imitate the human hand. VAV Technology GmbH produces the X-Burner system, a dry method of producing patterned effects on denim. This system allows a wide range of effects to be produced efficiently with minimum damage to the fabric. The VAV Technology for automated denim processing increases productivity, uniformity and quality of the finished product [16].

SOFTENING PROCESS

Softening process of denim is very critical. As denim is very heavy compared to other fabrics, it needs softening. During this process there is a big problem - the discoloration of denim i.e. changes in shade or loss of whiteness, giving a yellow tint, which is commonly known as yellowing. Using normal softener will lead to ozone problem. Indigo dyed fabric is even more prone to yellowing [2]. Hence it is advisable to use Antiozonate softener which prolong ozone reaction of indigo & keep garment in good condition [14].

Conclusion

Denim is both fashion and performance driven. As far as fashion is concerned, denim is the most fashionable and preferred dress among the young generation. Denim fabrics with multiple permutations and combinations of variables like fibers, yarns, and lycra % and weaving techniques can add a new dimension to the fashion world. Further, a number of technological factors have contributed to making denim the emerging fashion icon - including vast improvements in spinning, weaving, finishing etc. One of the most important parts of creation of beautiful denim is the washing which plays an important part in the denim chain because of the umpteen effects that the consumers are looking for on their jeans. Last but not the least, by increasing versatile variation in products along with improved quality, denim has full potential to open new markets and new horizons for denim industry.

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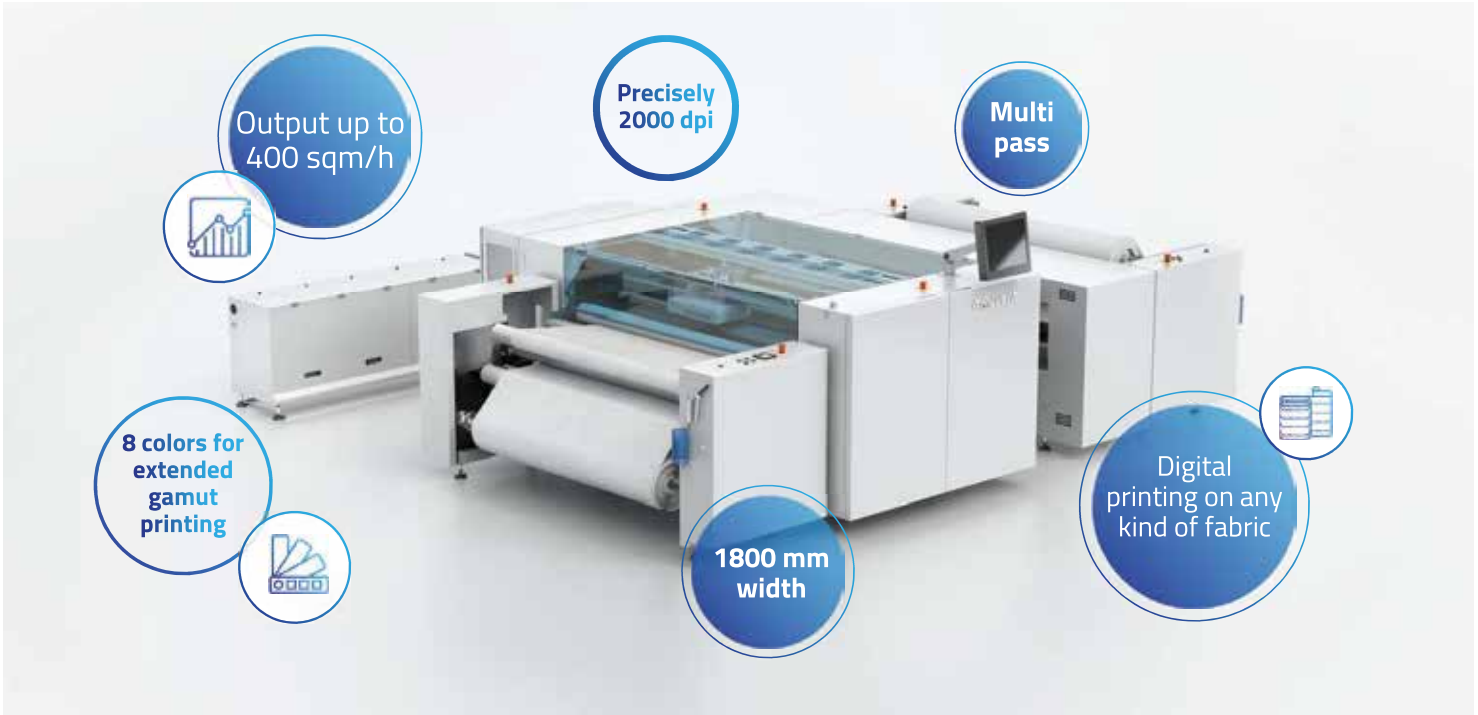

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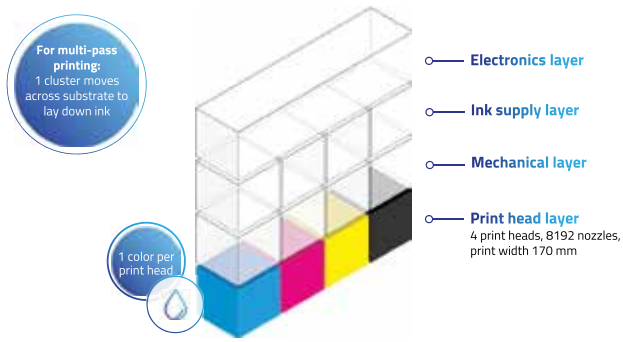

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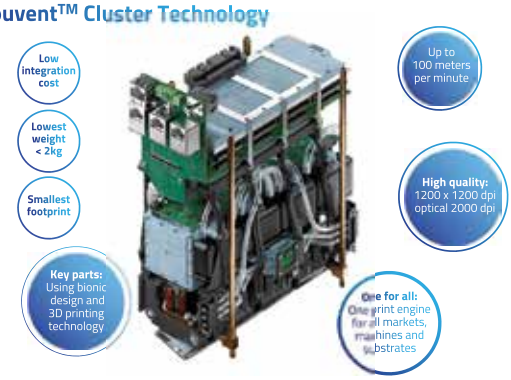

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FINISHING DEPARTMENT: A LONG LOST TREASURE OF GARMENTS MANUFACTURERS

ADITYA MAHAPATRA

In the present era of fast fashion, the order size is getting smaller and the lead time is becoming necessarily shorter; but, as on the contrary the quality expectation is growing higher, time is becoming the most critical factor to influence the bottom line for the success of any apparel export business. Keeping this in perspective, it's easy to draw the conclusion that, both- 1. Deviation from the standard method and 2. Flawed Work Measurement technique culminates in higher production cost and consequently reduced profit margin as they play the most crucial role in creating the base of production planning, project scheduling and costing.

Renowned Engineer William Thomson, 1st Barron Kelvin said, "To measure is to know. If you cannot measure it, you cannot improve it." But to the surprise, whilst many professional organizations are more than willing to commit to accurate and frequent measurement of the activities in the sewing room, benchmarking SAM values, OB Preparation; few are as willing to do so where inalienable production processes like finishing is concerned. Though it has been seen that, there are nearly 80 job descriptions in a garments industry where around 15 happens in pre-production and nearly the same number of operations in post-production stage (Jana P. , Skill is Not Only about Sewing Operator, 2014), very often these are seen to be ignored when it comes to setting time standard for the operations. These operations are still left out to guesses and hence are susceptible to inefficiency, low productivity and poor motivation.

So, in order to sustain in the longer run of the business and fulfill the expectation of continuous annual improvement in productivity and efficiency, it's need of the hour to introduce and practice work measurement techniques in finishing department also.

WORK MEASUREMENT TECHNIQUES USED IN THE INDUSTRY

Work measurement can be defined as the application of techniques designed to establish the time for a qualified worker to carry out a task at a defined rate of working (Barnes, 1958). The three principal techniques by which Work Measurement is generally carried out in industries are- 1. Work Sampling, 2. Time Study and 3. Pre-Determined Motion Time System (PMTS).

Work sampling, also known as 'activity sampling', 'ratio-delay study' and 'observation ratio study' is a method of finding the

Aditya Mahapatra

percentage occurrence of a certain activity by statistical sampling and random observations. Work sampling is mostly preferred for long-cycle operations rather than short-cycle repetitive operations (e.g.-sewing) and so, is not a popular work measurement techniques in needle trade.

The method which has garnered the maximum popularity in establishing the time standard is Time Study. Time Study practice performed in a logical manner may lead to accurate and fruitful result. But it's often a cumbersome process involving time, money and of course manpower and the result always comes with added subjectivity of the operators being studied. Due to the lack of uniformity and standardization in the method, time study values don't reflect in practice and a significant variation is noticed between the time values set and achieved.

The most scientific method

of Work Measurement is Pre-Determined Motion Time Systems (PMTS) Predetermined time standards (PTS) or 'Synthetic Time Standards', are interchangeably used terms , defined as work measurement technique whereby times established for basic human motions are used to build up the time for a job at a defined level of performance. It has for many years been, recognized as just that, consistent, accurate and dynamic in a changing environment. PMTS rely on predetermined times for known activities at known performance levels, and can therefore accurately predict the best method and the optimum time for a given task irrespective of operator being studied or the place where the study has been carried out. They provide a known benchmark and in so doing provide an accurate measure of performance, efficiency and output. There are a lot of PMTS solution in use in needle trade for benchmarking the time standard (e.g.- GSD, SSD, SPD, MODSEW, SewEasy etc.) but all of them are proprietary of the respective companies that either developed or acquired the data at a later stage.

Point to be noticed, apart from GCD (General Cutting Data) all PMTS solutions have so far been developed only for the sewing operations.

In the beginning of last decade, one module of PMTS solution called. GCD (General Cutting Data) meant for spreading, cutting, bundling, ticketing and other activities of cutting room was created by GSD Enterprise Ltd, UK but could not become a success. This failure could be attributed to the below reasons-

1. The very large work content of cutting room operations because it is comparatively easy to measure short cycle work in the sewing room whilst the activities in the cutting room are long and complex.
2. The longer the task the greater the opportunity for error when measuring, compiling and computing the "Standard Time" for that given activity.
3. Very less "frequency of occurrence" which are non-repetitive in nature and
4. The difficulties associated with accurate assessment of an operators "performance" may also raise questions as to the accuracy of the final results.

The number of variables within the cutting room often does render the results of any earlier measurements inaccurate for that altered state (Stitch World, 2004).

WHERE COULD IT ALL GO RIGHT?

As a result of the aforementioned reasons, cutting or finishing departments are the areas which are left to depend on probably the earliest measurement technique termed as 'Structured Estimating'. Apparently, the accuracy of this estimating depends on the experience of the estimator in the field and estimating is normally used where the required time values are not required in great detail. Such techniques are useful in long-cycle work and in situations where aggregated

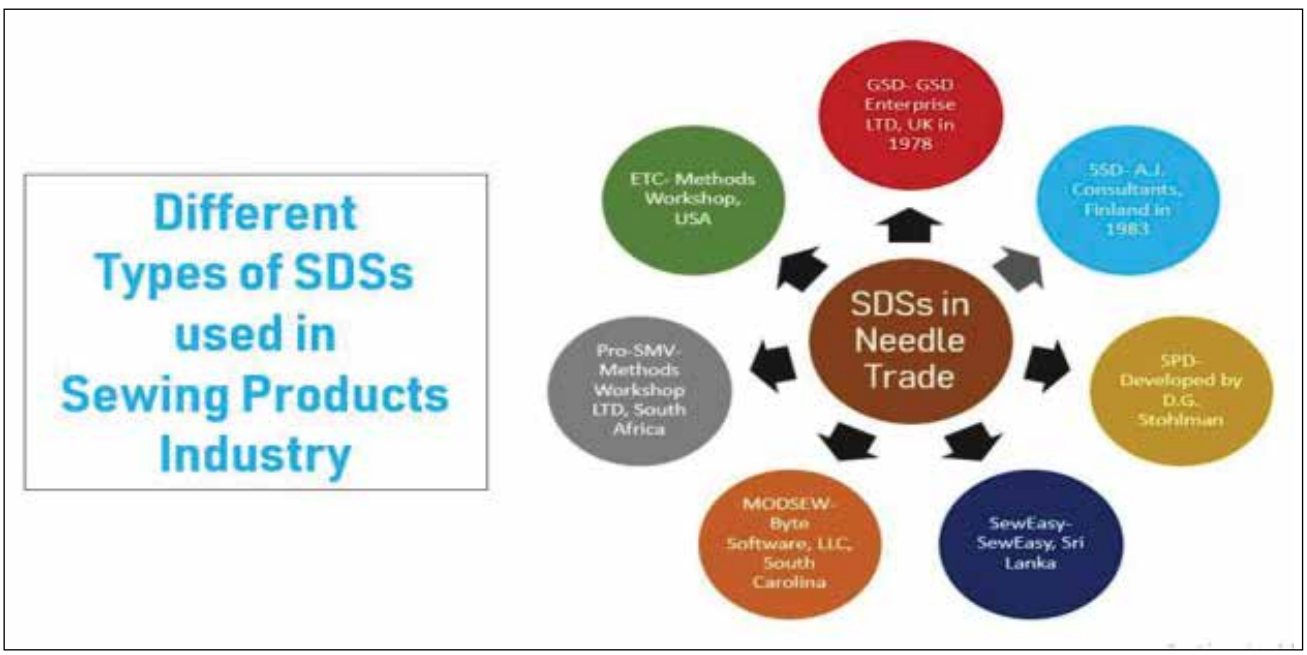

Figure 1 PMTS based SDS solution used in Garments Industry

Figure 2 PP Spraying

Figure 3 Denim Scraping

measurement data are used for planning, control or payment over reasonably lengthy time periods. Though cutting complies these conditions to some extent, the repetitive and often short-cycled nature of finishing operations demands the need of attention where a huge amount of money is being spent due to this negligence, lack of reliable time-value data, close supervision and serious monitoring during the production stage.

Though finishing constitutes an indispensable part of the entire production floor, we see least intention in industry to consider the operations of finishing when it comes to preparing the Operation Bulletin, setting time standard for the operations and close monitoring to reduce the deviation from standard, set as per international benchmarking.

But, unlike cutting or other time taking lengthy cycle operations, most garments finishing activities possess similar nature just like the sewing ones and satisfy all conditions what it takes to be considered for successful application any scientific Work Measurement Technique.

For Example, PMTS is very useful when operations are repetitive in nature and have higher frequency of occurrence (Jana & Tiwary, 2017). A task is considered repetitive if the cycle time is less than 30 seconds and task is performed for more than 50% of the work shift (Jana, Karthikeyan, & Mohankumar, Ergonomics in Apparel Manufacturing). Now, If we look at the finishing department of jeans trousers production unit, the operations like- rivet attaching, snap button attaching, tagging, belt loop trimming etc. fall in this category. Operations having longer cycle times like – scraping or whiskering may take more time than 30 sec but they include very higher number of frequency of one particular task-rubbing and having been one particular task, it occupies even more than 50% of entire shift time. So, there is enormous possibility of successful implementation of PMTS in finishing department. By now, we all have known that, PMTS is standardization irrespective of the operator and is just focused on the right way of doing any operation. And hence, time values derived from PMTS are fair to all operators (Jana & Tiwary, 2017). So, these facts indeed opens up the window of opportunities for application of scientific management in the area of benchmarking the time for the operations in finishing department of a production facility.

And it could not be any better than starting the practice with a jeans production facility. This industry avails itself of a huge advantage of avoiding handling delicate fabrics unlike any other mass production facilities (e.g.- shirts, T-shirts etc) what reduces down the amount of unnecessary motion while performing activities; facilitates the scope of method study, process engineering, standardization of work method and definitely makes it easy to make elemental breakdown of operations, study them and set the time-standard. These attributes essentially satisfy all conditions critical to the success of any scientific work measurement technique.

WHY SHOULD IT BE TRIGGERED FROM DENIM PRODUCTS?

Moreover, having enjoyed a lion's share in everyone's wardrobe, denim products have been able to comprise a global market valued at $56,178.1 million in 2017 and is forecasted to witness a CAGR of 5.8% during 2018–2023. Therefore, a classic, never out of demand products like jeans, dealing in billions of dollars in mass scale demands serious attention in its areas like finishing department which has been deprived of Work Study

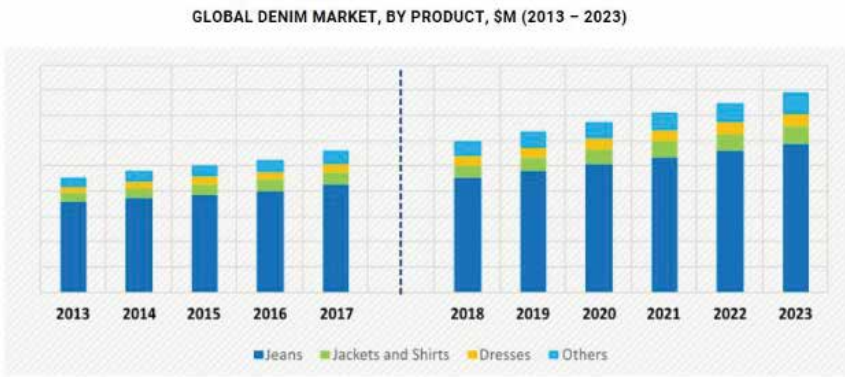

Figure 4 Source Denim Market (2013-2023) by P&S Intelligence

and application of scientific management since ever. And the production units are losing out on money what they could have earned as profit instead. So, finishing departments of a garments industry is indeed a 'long lost treasure' of garments producers what is worth exploring the opportunities of implementation of time benchmarking possibilities.

Case Study

'DataS (Astailor Shine Ltd.)', a company based in Romania, provides timeSSD®, a dedicated software for benchmarking the time of sewing activities using SSD (Standard Sewing Data). In a joint collaboration with DataS, a research work was carried out by me and Professor Dr. Prabir Jana, NIFT Delhi in an Egypt based jeans production facility- 'Emessa Denim for RMG' to check the applicability of PMTS in finishing department of jeans production facility. During this research project, by micro-motion study and using MTM, one PMTS based Standard Data System was developed for 7 jeans finishing operations- 1.Rivet Attaching 1. Button Attaching 2. Tag Attaching 3. Belt loop 4. Trimming 5. Topper Pressing/ Denim Blowing 6. Scraping 7. Whiskering. After establishing the SDS, sample operation videos were taken randomly from different countries and based upon their method, the time had been calculated using the established SDS and later was compared to the originally time taken by those operations. For 83% instances the variation was less than 5% and it never went beyond 7.5%. Earlier Sauer said that, "Experience shows that variations of 7.5% in the standard times found by stopwatch time study must be expected" (Sauer, 1950). This proves that, not only the finishing operations are suitable for application of work measurement techniques to, but also, implies that, the time predicted by the established SDS has been in the area of scatter of normal distribution zone and can successfully even replace the conventional time study method in the department. Thus it can lead industry to greater profitability.

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JEANS FINISHING AND LASER TECHNOLOGY

SOUMYADEEP SAHA

THE LASER TECHNOLOGY FOR DENIM FINISHING/ WASHING

With efficiency and sustainability driving the apparel industry, the process of denim and jeans finishing is taking a drastic change from its traditional method. Alternative methods of garment finishing, washing, the chemical process which will have minimum impact on the environment from denim industry has become a top priority. This article will focus on the use of Laser Technology on denim finishing which has the potential to make a change from the traditional way to something which is more modern and environment-friendly.

WHAT IS LASER TECHNOLOGY?

Lasers have long been used in the apparel industry for laser marking (for surface fading), laser welding (for joining two or more layers of fabric through melting it), laser engraving (controlled cutting to a depth), laser cutting (for cutting through the fabric). It is a device that generates an intense beam of coherent monochromatic light by stimulated emission of photons from excited atoms and molecules. CO2 RF discharge excited laser source is commonly used in the textile industry which has a wavelength of around 10.2-10.8µm.

CO2 laser is a gas laser with CO2 A laser medium and wavelength of approx. 10.6um. When high voltage is added to electrodes, discharging through the cavity will excite CO2 molecules and produce a laser radiation that can be directed to processed materials.

With laser, the traditional method of discoloration, abrasion, decoration, marking, engraving, and cutting can be totally replaced. Modern laser machines are equipped with z-axis automatic up & down motion to engrave various shadowed and textured patterns with distinct layer and color transition.

Soumyadeep Saha

DENIM LASER FINISHING PROCESS

The process of denim finishing starts with the creation of a digital file and illustrated in such a way that the laser can interpret. With this the garment becomes ready for the process. The garment can be kept on a flat surface or vertically stretched for the laser to engrave over it. Now most of the machines are Industry 4.0 and are equipped with circular type material feeding processing technology where in a single operator can load continuously in a way that the positioned garment will move forward in the belt while the operator prepares the next garment. The machines are also equipped with a projector beam that shows the laser projection area for fast and accurate setup and positioning. The software has also been developed to support a

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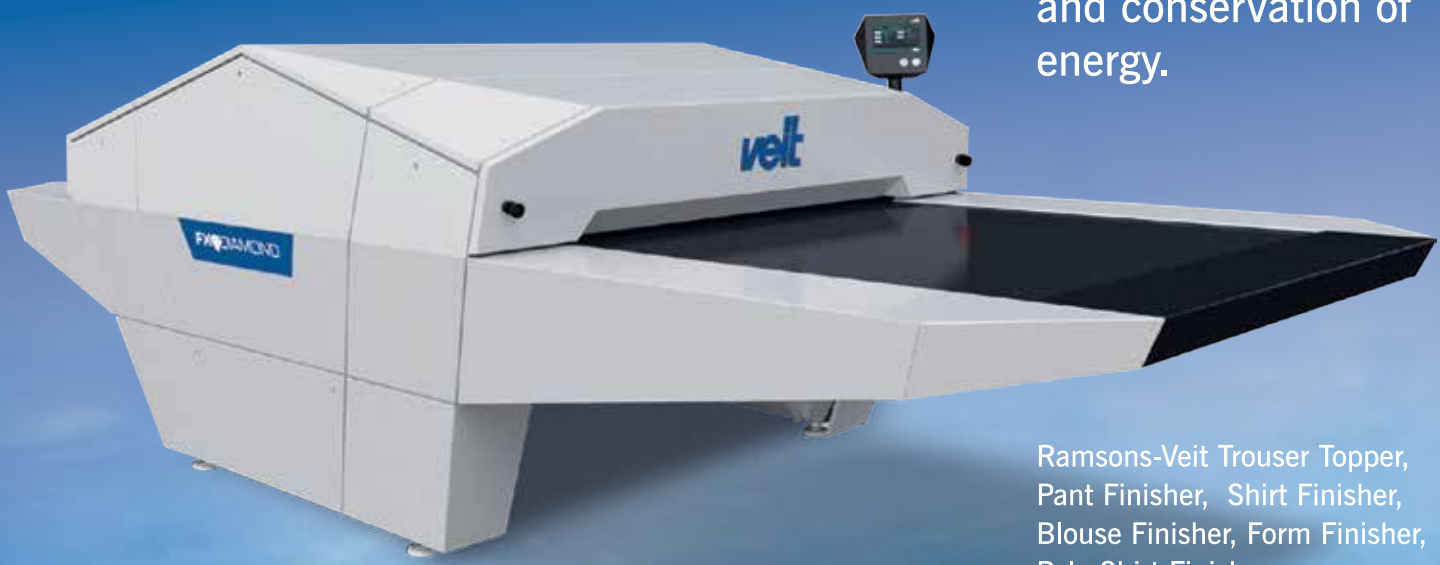

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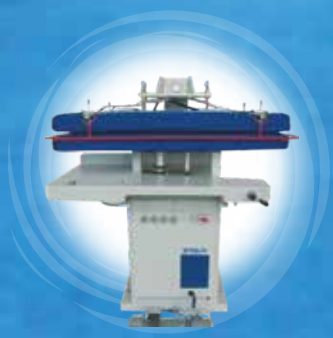
Shirt Finisher

Blouse Finisher



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The technology has been able to replicate most of the wash effects with the various shade like the stone wash, mill wash, moon wash, bleach, PP spray, monkey wash, cat whiskers, snow wash, holing, tinting and so on.

ADVANTAGES OF LASER FINISHING IN THE DENIM INDUSTRY

Some of the major advantages of using laser denim finishing are:

1. The possibilities of designs can be immense, making the wash effect more precise, uniform and defect free. The designs can be placed anywhere on the garment depending on the requirement.
2. Being a physical process instead of chemical, no such pre or post processing of the fabric or garment is required and can be done even on finished product.
3. The technology is moving forward to technology wherein the machine can be automized and can be integrated with various online processes.
4. It is a much faster process as compared to the conventional finishing process as it is able to eliminate the need for multiple wash stages lowering production time.
5. It can be made suitable for a wide range of materials such as wood, paper packaging, plastic products, label paper, leather, cloth, glass, ceramics, resin, bamboo products, PCB panels.
6. This process is totally environment-friendly with comparatively negligible use of water with no use of chemicals.
7. Elimination of the various wash and finishing stages has decreased the labour and process cost reducing the production cost exponentially.
8. Saves denim fabric from damages caused by traditional tools, chemicals, stones and bleaches etc.
9. There is comparatively less strength loss with low hairiness as there is no forced handling required which may differ in case of stretch denim.
10. Industry 4.0 ready as well as compatible with the traditional manufacturing process as the newer machines are equipped with conveyor system and the only human requirement is placing the denim in the projected position.
11. Use of software library to easily achieve wear marks and controlled breakage on textiles with different levels of ageing effect on garments which can be reused for later times.
12. It can totally eliminate the need for having an inventory, as any quantity of finishes can be replicated from just a laser file and a post wash also paving a way to On-Demand-Manufacturing.
13. A laser treated denim garment can be worn instantly after the fading process as there is no change in pH value during the process.

DISADVANTAGES OF LASER WASHING OF DENIM

Some of the disadvantages which are preventing its practical application are:

1. For small and medium-sized factories initial investments are very high compared to the traditional method.
2. Skilled machine operators along with designers required.
3. Often some designs or fading require a manual touch even after laser finish to produce a natural look, which avoids the use of laser in the first place.

The use of laser technology has brought about some major changes in the industry by reducing water wastage dramatically as such as 50l of water for each pair of jeans compared to the traditional water finishing process. It has also reduced the use of the toxic and chemical substance in different stages of production, especially during treatments to achieve particular effects of jeans keeping the productivity from about 70 to 170 garments per hour. It has also reduced the rejection to 0% which previously was due to natural or manmade variations that were out of the tolerance level.

For example, Levi's has collaborated with Spanish industrial laser specialist Jeanologia for technology to digitalize the process of denim finishing, achieving their goal of zero discharge of chemicals by 2020.

This technology has redefined the future of denim as a whole. It has also made it possible to completely sync with the concept of the green industry providing cleaner production with better chemical, waste and energy management.

About the Author

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SEWING AUTOMAT SOLUTION FOR JEANS MANUFACTURING

PRIYABRATA MONDAL

Industry moving towards automation, robotics, IoT system, and big data, and new words "Industry 4.0" is continuously buzzing in the air, in this scenario apparel manufacturing industry is following the same trends to make high demand, low volume and high variation product in shorter lead time. So, only depending on manpower is nothing but a stupid decision whereas, in the other sector, automation already takes control over fully, then why the garment industry would lagging! To be competitive in the market one should know the proper utilization of automatic machine for industry-specific way. And the whole industry should look at the position to reduce the human efforts. We can see in the current situation in the world of manufacturing industry, the cost of the labours is gradually increasing, so for the labour directing industry like, the apparel industry is also expanding consistently. To stand in the market one should adopt the automation very fast to take themselves far away from others who have not been adopted yet. (Jana, 2017).

In such a condition, utilization of automats not just a reliance on labour, yet additionally helps up the productivity in terms of profitability. A few years back, the amelioration of the productivity and manpower utilization is very difficult for an apparel manufacturing unit, when automats were just a sci-fiction to this industry, but today use of automats have brought significant improvement in productivity and quality by reducing operator dependency through job deskilling. (Jana, 2015) So, when it is a matter of automation, then how much one should automised think to measure it.

Renowned Engineer William Thomson, 1st Barron Kelvin said, "If you cannot measure it, you cannot improve it". So, when you are going invest your valuable money on automation before that one should know how to do the standardisation of that automatic and semi-

Priyabrata Mondal

automatic machine when there is less human intervention when there are human motion and stitching happening parallel. Once it has standard data then, this can help an Industrial engineer to plan the capacity accordingly.

WHY AUTOMATION IN GARMENT PRODUCTION

A garment industry's competitive advantage in the global market depends on the level of advanced technologies and automatic tools and equipment that are used in its designing, production planning, manufacturing, supply chain, and retailing. (Rajkishore Nayak, 2018). Garment manufacturer can

easily meet the international market for the cost-cutting edge and maximum quality by continuous adoption of new technologies and automation for Quick response and JIT production. Adopting automation is highly budget oriented that is the biggest challenge for many developing countries to install a fully automated factory.

JEANS AUTOMATIC UNITS

Various type jeans automatic machines

1. Double-head Pocket setter
2. Automatic Pocket Designer
3. Automatic Pocket Setter
4. Automatic J-stitcher
5. Automatic Side Seamer
6. Programmable Label Setter
7. Automatic Belt-loop Setter
8. Automatic Denim Overlock
9. Jeans Side Seamer
10. Back Pocket Hemming
11. Pocket Facing Workstation
12. Waistband Attaching Unit
13. Feed-off-the-arm Chainstitch
14. Automatic Bottom Hemming
15. Programmable 2-Needle Sewing
16. Single Needle Post Bed Tacking
17. 3-Needle Lockstitch Sewing
18. Front Pocket Hemming
19. Automatic Button Punching
20. Folding and Creasing Machine
21. Beltloop Ends Cutter
22. Jig Sewing Unit
23. Pocket Facing Unit
24. Dart and Pleat Seamer
25. Automatic Serging Unit

SIMULATING MAN VS MACHINE OPTIMIZATION MODEL AND ITS APPLICABILITY

In the below Figure-1, two machine set-ups are being shown how a man can operate two back pocket setters together. In the various model of automatic back pocket attachment machine currently available in market, can be simulated in 1:1 & 1:2-man vs machine configuration.

In below chart Table-1, after applying pre-determined motion and time system we can conclude some solution where we can see the productivity in two configurations.

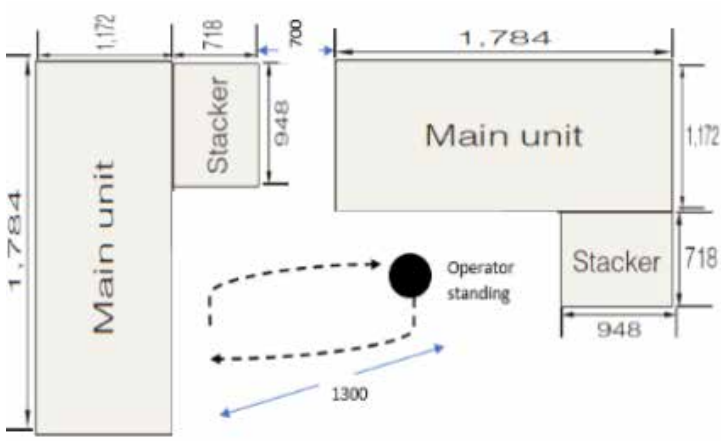

Figure-1: Machine layout for 1:2 Man Vs Machine configuration

Table-1: Productivity chart of different types of automatic sewing machine

	Category / Company name	Different types of customised automatic sewing machine		
		Back pocket setter (mono)	Back pocket setter (multi thread)	Serging machine
Time related data	TST time	0.191	0.201	0.088
	Total cycle time	0.432	0.510	0.162
	Operator waiting time	0.033	0.045	0.033
	Operator waiting time % (upon Cycle time)	17%	22%	20%
	Total operator handling time	0.147	0.147	0.055
	Operator handling time % (upon Cycle time)	77%	73%	34%
Utilization %	Man utilization %	77%	73%	63%
	Machine utilization %	100%	100%	100%
Productivity related data	Production/hr at 100 % operator eff (complete garment)	157	149	170
	Production/day (complete garment)	1257	1192	1364

In the country where human wages are much higher, we can do 1:2-man vs machine configuration. In the Table - 2 & 3, comparison chart is for single needle head machine among the various brand where the productivity is coming higher in PFAFF model, around 1283 pcs of complete garment. This model has the man & machine utilisation percentages are 75% & 100% respectively. So, we can't underutilise the human for the country where wages are higher. So, in that case we can think about buying two machine and utilise human 100%. In the comparison chart (Table 4) IMB china machine is showing more effective to buy this model.

Table-2: Brand wise productivity comparison of auto back pocket setter

	Category	Comparison Table for Mono colour thread							
	Company name	SIP-Italy		IMB-China		PFAFF		Juki	
	Man vs Machine config	**1:1**	**1:2**	**1:1**	**1:2**	**1:1**	**1:2**	**1:1**	**1:2**
Time related data	**TST time**	0.191	0.327	0.215	0.248	0.187	0.304	0.226	0.248
	Total cycle time	0.432	0.432	0.383	0.383	0.391	0.391	0.395	0.395
	Operator waiting time	0.033	0.158	0.102	0.124	0.046	0.152	0.113	0.124
	Operator waiting time % (upon Cycle time)	17%	37%	27%	32%	25%	39%	29%	31%
	Total operator handling time	0.147	0.158	0.113	0.124	0.141	0.152	0.113	0.124
	Operator handling time % (upon Cycle time)	77%	37%	29%	32%	75%	39%	29%	31%
Utilization %	**Man utilization %**	77%	97%	53%	100%	75%	100%	50%	100%
	Machine utilization %	100%	58%	100%	87%	100%	62%	100%	91%
Productivity related data	**Production/hr at 100 % operator eff (complete garment)**	157	183	140	242	160	197	133	242
	Production/day (complete garment)	1257	1468	1116	1935	1283	1579	1062	1935

Table-3: Brand wise productivity comparison of auto back pocket setter

	Category	**Comparison Table for multi-Color thread**		
	Company name	SIP-Italy	AMF Reece	PFAFF
	Man vs Machine config	**1:1**	**1:1**	**1:1**
Time related data	**TST time**	0.201	0.211	0.17
	Total cycle time	0.510	0.409	0.421
	Operator waiting time	0.045	0.07	0.023
	Operator waiting time % (upon Cycle time)	22%	33%	14%
	Total operator handling time	0.147	0.141	0.161
	Operator handling time % (upon Cycle time)	73%	67%	95%
Utilization %	**Man utilization %**	73%	67%	95%
	Machine utilization %	100%	100%	100%
Productivity related data	**Production/hr at 100 % operator eff (complete garment)**	149	142	176
	Production/day (complete garment)	1192	1137	1412

Table-4: Cost calculation

AUTOMATIC BACK POCKET SETTER (One Head)				
Machine model	MB1002C-BR-1-BAS311HN		PS342-FG1SIP.V2	
Machine config	1:1 Man vs Machine	1:2 Man vs Machine	1:1 Man vs Machine	1:2 Man vs Machine
CM price of the garment (Rs)	300		300	
Sewing cost 40%0f Rs 40	120		120	
SAM value for the operation(min)	0.43		0.382	
Total SAM (min)	19.11		19.11	
CM price per pocket (Rs)	2.70		2.40	
SAM value for single operation(min)	0.430	0.248	0.382	0.327
Production per day (shift of 8 hours)	1116	1935	1257	1468
Working days /month	26	26	26	26
No. of months /year	12	12	12	12
Production per annum	348279	603871	392042	457982
CM price per pocket	2.70	2.70	2.40	2.40
Cost output/annum	940408	1630546	940408	1098581
Production Target(pcs/day)	1935	1935	1468	1468
No of machine required	2	1	2	1

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DATATEX SOFTWARE SOLUTIONS

RAHUL MAHAJAN

Datatex AG has been designing and developing IT solutions for Textile and Apparel Industry since 1987. With more than 400 implementations across 42 countries, Datatex has made a positive impact in global textile and apparel industry.

NOW ERP is the flagship product from Datatex. NOW (Network Oriented World) is a web based (100% Java-J2EE) ERP which manages End to End Business Processes across all the Textile supply chain segments like Spinning, Knitting, Weaving, Processing and Apparel Manufacturing in multiple sub verticals like Denim, Worsted, Non-Woven, Home Textiles, Technical Textiles, Carpets etc.

As it has been developed for Textile and apparel industry, NOW has multiple features that make it acceptable across the industry sub verticals.

NOW Planning takes care of Material Planning as well as Production Planning required across the entire Textile Supply Chain. Thus, in case of an order of Finished Garment, it plans material requirement for Fabric, Sewing Trims, Packing Trims, etc for the entire order. It also calculates the production quantities at intermediate levels such as Cut Product, Sewn Product and Finished Product, etc. In case of Finished Fabric, it calculates Greige Yarn Requirement – for Warp and Weft (in case of Knits it will calculate overall Yarn requirement) and Dyes & Chemical requirements. It calculates production quantities at intermediate levels of Dyed Yarn, Warp Beam, Greige Fabric, Finished Fabric, etc.

NOW Planning works for MTO as well as MTS scenarios. It can also manage mixed scenario as required by many Textile organizations. The Planning is governed by organization specific, totally configurable rules to arrive at the right plan. Sales Inquiries / Orders explode automatically and generate Production Demands and Purchase Requests at multiple levels. It takes care of stock netting, allocation, batching and optimization rules at multiple levels.

The modules of sales, purchase, warehousing understand the typical requirement of textile organizations. Be it partial orders from customers, quality checks at material receipts or need of storing different materials in different unit of measures or quality levels, or producing one customer order on multiple machines or to club multiple customer orders in a single batch NOW has it all – configurable as per individual organizational requirements.

The plant maintenance module schedules preventive maintenance automatically along with the material and tools required. Costing module helps users do pre-order and post order costing along with deviation report. Finance module has General ledger, account payable, account receivable and asset accounting functionalities along with reporting needs of PL and Balance Sheets are various levels as per the practises at implementing organization.

What sets NOW apart is the ease at which users can use it for day to day transactions in individually configurable screens, perform status analysis online as well as in the form of reports. Datatex NOW – a truly global ERP, configured as per the specific needs of the textile and apparel organization helps users to take better and faster decisions to communicate internally as well as externally.

Apart from NOW, Datatex also has special solutions for planning and scheduling for the textile and apparel organizations.

For Capacity Planning needs across the multi plant/ multi location organizations, Datatex MCM is deployed. It is typically used by planners and supply chain managers.

MCM is a graphic tool, showing the percentage of capacity booking of plants or work centres (work centres and group of machines having same features) and hence the availability for new orders. Supply Chain Managers can see available capacities of other plants to take decisions involving multiple production units.

MCM helps the planner to organize production requirements considering machine capacity, materials (Stock, supplier orders, WIP, etc), additional resources (tools, human resources etc.), initial requested planned dates and so on.

MCM automatically places production requests coming from the ERP on the planning board, according to pre-defined business rules (Request date, compatibility etc) lessening the burden of planning the standard or regular productions. Each request is scheduled on Gantt only once, unless a planner decides to reschedule or unless the original request is changed (like date, type of capacity etc).

For the plant level planners which are also department level planners, Datatex has MQM – the scheduling tool.

MQM is user friendly, graphic semi-automatic tool to schedule jobs on specific machines. It can be used for any kind of machines - be it Ring-frames, Weaving Looms, Dyeing Vessels, Finishing Machines or Cutting Tables, Sewing Lines or Washing/ Dyeing Machine. The planners can Pick & Drop, Split the Jobs, Group the Jobs on Planning Board Itself. (One Customer PO on multiple vessels/ production lines). Users can create Business Rules to identify the Best Machine for a Job e.g. Spinning Lines, Plain/ Dobby/ Jacquard or 2 /4/ 8 Color weft or Garment Styles etc. MQM also understands business rules to identify Best Sequence for a job on a Machine (White orders/ Light/ Dark Orders), Inter-linked Scheduling Like Weaving Plan is linked with Finishing Plan, Cutting Plan is linked with Sewing Plan and also availability of material and Special Tools (Reeds, Cams, attachment) Availability

Using these planning solutions, the supply chain team and planner get more time to plan iterations due to uncommon business situations of customer demand or plant breakdowns or material availability issues.

Datatex also has software solutions for managing shop floor operations of production recording, stoppage recording, issue of material, machine status monitoring and fabric inspection. These solutions are part of automation products which can integrated with machines (via PLC or microprocessors) or can work independently. The user-friendly screens (big fonts, very few – production relevant fields with auto/ pre filled information using barcode or QR code scan makes CAMS very easy to adopt and use practically.

Realtime shop floor data is available in the ERP for seeing the status of shop floor. The planners and business teams thus have real time information of material (final products, intermediary products or raw material), or machines (running job, previous job, efficiencies, stoppages).

Datatex solutions can be implemented together as a complete suite or can be deployed by specific modules as per business needs.

All Datatex solutions are configured for each organization based on specific needs of the business and production teams. Be it forward, backward or lateral business expansion, the managements can be rest assured that Datatex solutions will manage new business in the same software. And this has been fulfilled promise since the last 30 years now!

NATURAL DYES

YAWER ALI SHAH

Textile industry is putting all its best efforts to achieve 100% sustainability. All the related brands and mills are making valiant efforts for the purpose. But still there is a long way to go. Natural Dyes is a kind of an unexplored area while approaching sustainability; may be due to data-unavailability for measuring its sustainable benefits.

AMA Herbal Laboratories Pvt. Ltd. in India has broken the shackles in the textile industry by introducing Bio Indigo® dye along with detailed Life Cycle Analysis (LCA) study for the very first time.

Utility of LCA Study: It is a scientific, analytic approach in measuring benefits that brands can get on sustainable balance sheet by switching to natural dye.

Correspondingly, LCA study of Bio Indigo® dye elaborates about the benefits brands can get on sustainable balance sheet by just switching to Bio Indigo® in denim production.

Source of Bio Indigo®: Bio Indigo is obtained from leaves of a plant named Indigofera Tinctoria. Common name of this plant is Indigo and it is enriched with medicinal properties as well.

Natural benefits of Indigo Plant: It enhances soil fertility. Many coconut farmers have reported higher yields in coconut water by planting Indigo in the periphery. Indigo plant is a good source of Nitrogen when used as compost.

Bio Indigo® comes in powder form and it has attained world-known sustainability certifications like 'GOTS Version-V', 'ZDHC', and 'REACH' etc. Its fastness properties, dyeing-process and method of use remain the same with synthetic indigo. Several big denim mills from India, Bangladesh, Turkey, China, Italy, and Japan have shown their trust in Bio Indigo® and they are using it on their rope-dyeing machines. Designers are admiring it as they like its greener cast and the beautiful cut effect it provides.

Indigo blue and denim are like two inseparable souls. In the beginning time, denim was dyed with Natural Indigo only but now synthetic indigo has turned the things around. Synthetic Indigo is outcome of chemical process with a purpose of commercial usage in textile industry.

Positive Environmental Impacts of Bio Indigo®: AMA Herbal has evaluated positive environmental impacts of Bio Indigo® with help of LCA Study exactly as per ISO 14040/44 standard. AMA assigned responsibility to Thinkstep Sustainability Solutions Pvt. Limited, a subsidiary of Thinkstep AG, Germany for the LCA study of Bio Indigo® dye using GaBits Software system and Thinkstep Professional databases and services. The detailed study clearly indicated about the environmental benefits of Bio Indigo® and it also mentioned that it is definitely a sustainable dyeing option than synthetic dye.

Synthetic dye consumption is lesser than natural indigo dye for dyeing 1kg of cotton yarn. In order to make a fair analysis, functional unit was defined as 1kg of dyed cotton yarn. Inventory used in analysis comprised of entire production steps from producing indigo leaves in farms to Bio Indigo® production followed by its usage in cotton yarn dyeing. Identical system boundary was followed with synthetic dye as well.

Rope Dyeing, the most common dyeing-technology in textile industry was picked. It refers to twisting yarn into rope and then it immediately dipped into indigo baths. This dyeing method is used to achieve a better dyeing uniformity.

Dyeing with Bio Indigo® dye has 16% lesser acidification potential, the global warming potential was 9% lower, the primary energy demand was also 8% lower whereas the fresh water demand was 0.4 % higher. The difference in the positive impacts was in the range of 0.4%-23% for various environmental factors defining sustainability of denim.

Purpose of Study: The study was conducted to compare environmental impacts for production of 1Kg of both dyes.

Environmental Impacts are 10-100% lesser in case of Bio Indigo® dye except the fresh water consumption.

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KEY FINDINGS OF STUDY:

- The impact contribution of dye production in both cases of dyed cotton-yarn production is not more than 8-9% across different impact categories. Major impact contribution comprises of cotton yarn and energy consumption in rope dyeing process. It is proven now that using Bio Indigo® leads to impact reduction. Along with that, dye water waste of Bio Indigo® can be used for agricultural purpose as a source of Nitrogen.
- Dye's impact majorly depends on the quantity of dye required. Smarter use of Bio Indigo® will lead towards further impact reduction.
- This study gives Life Cycle Inventory (LCI) and Life Cycle Impact Assessment (LCIA) as regional averages (India) across the industry for dye manufacturing.
- Choice of modeling approaches and assumptions, and decisions can affect the results of LCA
- Due to limitations in LCA methodology, Biodiversity is not addressed in this study.
- Due to high level of their uncertainty, decisions shouldn't be taken on toxicity parameters. But Bio Indigo® certainly has lesser impacts when compared with synthetic dye.
- Bio Indigo® can deliver a sustainable solution to many denim brands and manufacturers. It is scientifically proven that natural dyes have certain advantages over synthetic dyes. Natural dyes are enriched with non-toxic, non-allergic properties and now it can be said that they certainly have an upper hand comparing to synthetic dyes.

AMA Herbal Laboratories understands that sustainable materials are needed to make a sustainable fashion arena. Bio Indigo® is the outcome of such endeavor and it is delivering exceedingly well.

Along with Bio Indigo® in-house R&D team of AMA Herbal has created few other natural dyes as well with a purpose of empowering the sustainability. Those dyes are mentioned underneath-

- BEE (extracted from wood of Acacia Catechu Tree)
- INSECT (made from rhizome of Rheum Emodi)
- KAREEL (extracted form of the Terminalia Chebula)
- MALLOW (extracted from peel of Pomegranate)
- NIMBUS (extracted from sticks of Kerria Lacca)
- RENNET (extracted from Gall Nut of Quercus Infectoria)
- RUBIA (extracted from roots and rhizomes of Rubia Cordifolia)
- YELIONA (extracted from Tegetas Erecta, Butea Monosperma)

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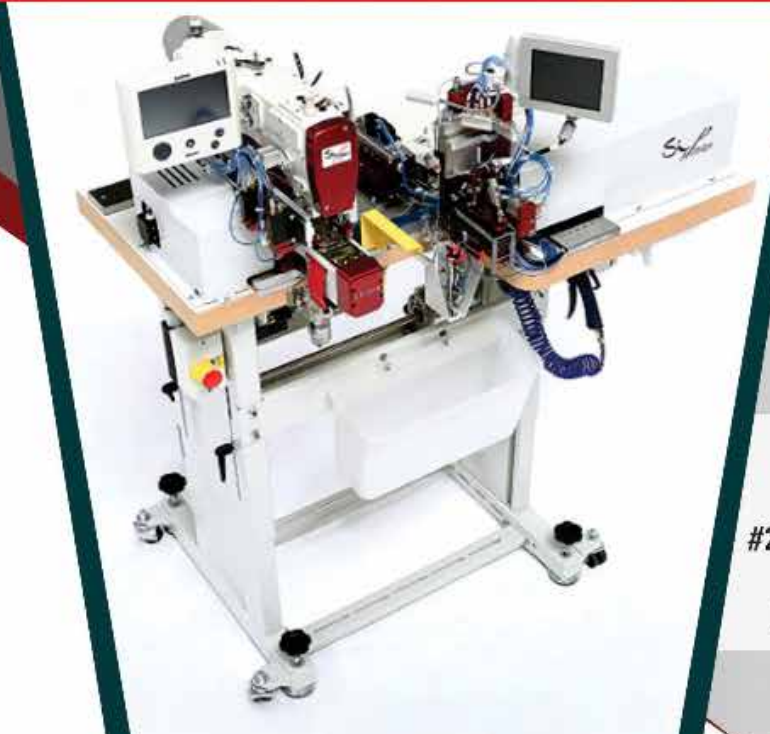

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NEED OF DIGITAL PRINTING

VINOD KRISHNAMOORTHY, FORTUNA COLOURS & PRINTS LLP

The latest ITMA, Barcelona Exhibition showcased all possible technologies from yarn, weaving, printing, water treatment. 2019 was all about sustenance and environment friendly to protect our Mother Earth. With growing changes, demands, technology usage, the call for fast Fashion has become a serious challenge and of great importance with twelve months Fashion, shorter quantities, more designs and on-demand manufacturing. All Fashion Brands want to sway clients with the concept of on demand, your own Design and create a new shopping experience for consumers.

THE SOLUTION IS DIGITAL PRINTING

More and more companies are now trying to build solutions to cover this demand. Aeoon Austria is one such company providing Direct Digital printing with Pigment inks for T-Shirts, Denim, Kids wear, or any such applications in the fashion world.

For Indian market or South East Asia exports, domestic sales and online all of it needs solutions like these. The challenge to reduce running costs is on and we at Fortuna Colors & Prints are setting up an R&D and application Centre. This will be a support Centre, innovation Centre creating value of knowledge and opportunities for Indian clients to utilize technology far more easily.

Fig.-2: Different pallets for different products

Fig.-3: A sample printed by a digital printer

WHAT DO WE BRING WITH AEOON?

Pigment Printing: Worldwide pigment is widely used in traditional printing but last few years it has taken a lot of importance in the digital printing world. A binder treatment, a printing ink and a curing solution makes it an eco-friendlier process and not involving water usage to wash off! Our country needs water saving technologies, and this has serious value going forward.

Flexibility: As a placement printer Aeoon brings flexibility with numerous types of pallets to accommodate various garments, which makes it easier for a fashion driven brand or manufacturer to utilize technology spread over vast range of articles.

With 2 Decades of experience in Digital Printing and having launched dozens of brands in the field of digital printing, the evolution gives me satisfaction as well as deeper insight to what's required.

Digital does not necessarily mean it's like a photocopy machine to press a button and get an output. It requires proper understanding, care, knowledge, and well-equipped team. We as a company are trying to address this challenge on the ground. To build more confidence and trust to adapt to technology.

Fig.-1: Digital garment printer

NEW ERA OF INDUSTRIAL SEWING MACHINES

DAVID PETER

We make with passion special sewing machines for jeans and trouser industry. SIPITAY is focused on “A top class” apparel industries, interested on best product for engineering, quality and daily productivity output. SIPITALY manufacture complete range of automatic sewing machines for Jeans and casual trousers.

We develop special industrial automatic sewing machine for jeans and apparel industries worldwide.

Our passion team has more than 30 years working experience in this field. Our plan located in Verona, North Italy. We achieve the goal to manufacture friendly use automatic workstations, with the best ratio in terms of productivity and versatility at the lower running cost.

Most of our Automatic workstations are equipped with common electronic hardware and high quality sewing head, it is the best technical solution giving incredible benefits to our users.

Best Products made with best supply chain! This is one of our strength and business strategies, Thanks to the management credibility and reputation, we are proud to have a successful technical cooperation with major Japanese sewing machine manufacturing companies in this field.

SIPITALY sewing in cooperation with our distributors are the best proposal for complete turnkey solution for new green jeans factories. This kind of total turnkey solution is a mix of best advance technology and garment productions know how.

SIP Italy Having its liaison office in Bangalore south of India, SIP INDIA and sub office in Mumbai and Ahmedabad with a strong technical team to support our customers all over India and overseas also.

Losing in Efficiency is the BIG PROBLEM in sewing handling and SIPITALY provides the SOLUTION.

SUSTAINABLE THINKING

SAI NAVNEETHAN

Being Environmentally responsible means that every machine we produce, must consume less water and energy. We put our best minds at work to build and upgrade our machine to conserve our natural resources. We've infused ground-breaking technology into every machine we make resulting in high-efficiency, environmentally responsible products. Having achieved "reduced water consumption", Ramsons products also ensure reduced chemical consumption steam and ETP load. **Some of our Sustainable Products are** Go Green (nanotechnology), Mayin 3 in 1(ozone / nano/ low liquor process), Ozonator, Laser tex machine, Jet spray vertostar & Converized drier.

GO GREEN (NANOTECHNOLOGY)

Conventional technologies seek the utilization of huge amounts of water and chemicals during the process of fabric finishing. The quantity of discharge produced whilst this procedure is also high and harmful. Despite the ill-effects, these procedures have remained untouched since decades due to lack of a reliable alternative. The latest innovation of Ramsons-Go Green Technology is a greener and earth-friendlier alternative for the fabric finishing and is undoubtedly an innovation for the future.

SPECIAL FEATURES

- Water savings up to 95%
- Chemical Saving More Than 60%
- Zero discharge
- No Cost of E-Fluent Treatment
- No Extractor Needed
- This unit can be connected to Existing Washer

PROCESSES

- Softening
- Enzyme (Denim & Non-denim)
- Garment Dyeing
- Resins

MAYIN 3 IN 1(OZONE/ NANO/LOW LIQUOR PROCESS)

Ramsons has designed and manufactured a compact all-in-one sample washing machine for development of samples to meet the customers demand and latest trends of apparel industry. It is fully automatic washing machine with inbuilt ozone generator &

also equipped with Nano spray technology. This machine is equipped with latest PLC to store the program required for all type washing & special effects on garments and fabric samplers.

Features :

Ozone: The machine has inbuilt Ozone generator controlled by PLC and also Ozone destructor as per compliance. It is also supplied with Ozone leak detector & Ozone analyzer.

Nano Spray Technology: Ramsons Go-Green is an inbuilt feature of this machine. This has a high-pressure pump with spray nozzle to create fine mist. This process reduces the consumption of water chemical beside increases sustainability of the industry.

OZONATOR

Ramsons Ozone generator is manufactured with latest German Technology which produced high concentration ozone

- High concentration ozone generator with modular design for better safety and trouble-free running.
- Fully automatic control system with PLC. Can store up to 100 programs and easy to operate.
- Modular design of the ozone generator can run produce the ozone independently and provision to switch off modules when lower capacity is required.
- Vent ozone destructor with both heating and catalytic convertor for faster disintegration of ozone.
- Skid mounted oxygen concentrator to produce high purity oxygen.
- Increased safety features with additional leak detectors for the ozone generator
- Total turnkey support for installation as per the compliance. Will provide the safety norms with the layout drawing and assist in installation

LASER TEX MACHINE

- Accuracy of the laser is 100% due to projector system and synchronization between projector and conveyor
- The same machine can be used for Garments(All Types including Trousers, Shirts, Shorts, Skirts, Knitwear, etc...) and fabric rolls.
- One tube with cover the full garment without the need to mix laser tubes for the same garment they while preventing change in intensity as is the case with many other laser manufactures.
- The conveyor can be used individually or both as the process demands.
- The Laser tube is from M/s Coherent USA
- The Marca full graphics interface (Software + Dongle key for supervisor access + TCP/IP Cable) is provided
- 1000 free design package (Whiskers, Hot Spots, Chevrons, Scrapping and vintage effects, Destroyers, Brushing effects etc.) are provided

JET SPRAY VERTOSTAR

- Variable speed inverter drive with 6-40rpm for Washing and 80-120rpm for extraction.
- This machine has a microprocessor-based programmer to control different cycles of the dyeing program like timing, temperature, dosing etc.,
- Controlled indirect heating and cooling system. The machine will have stainless steel (SS) heat exchanger coil for both heating and cooling with pneumatically operated control valves, the heating gradient can be programmed through the PLC up to 6degre per minute. This system can also be programmed for controlled cooling of liquor bath.
- Two tank dosing system consisting fully SS tank fitted with stirrer. These tanks are provided with water inlet and pneumatically operated valves and SS pump for dosing. It is also supplied with level sensors which are controlled by the PLC for progressive and digressive dosing.
- This machine has specially designed wedges to ensure minimum beating of the garment. This feature will allow the garments to oscillate in the water without any beating.

Jet Spray Vertostar

- This machine is supplied with imported water flow meter to ensure exact quantity of water to be filled into the machine which is controlled by the programmer. Also the machine is fitted with a visual level indicator to check the water liquor level during the process.
- The machine is provided with dual drain which can be opened depending on the process cycle. This feature can be used for water reuse thereby reducing the ETP capacity.
- This machine has 2nos of pneumatically operated valves for water inlet. Additional water inlet can be provided as optional feature.
- This machine is provided with PH testing port and sampling port on the main door.

CONVERIZED DRIER

- RAMSONS would also like to introduce "SUSTAINABLE DRYING SYSTEM" called CONVEYORIZED DRYER.
- This system takes 70% Less Energy than standard tumble drying system.
- It helps you to avoid problems like Back staining, Lycra Damage or Garment DE shape etc.

ADVANTAGES

- Energy saving (steam + electricity)

No backstaining: Crocking occurs when exceeding dye rubs off one garment onto another garment. Our Conveyor Dryer avoids Crocking caused by the friction generated in Tumble dryers.

- No damage of lycra: No damage of lycra due to higher temprature + abrasion
- No yellowness on garment: No chance of Over Drying hence no yellowness on light fabric.

From the last 6 decades Ramsons is a pioneer and leader in the Manufacture of all modern day Garment Manufacturing Equipments and other co-related equipments. Ramsons have 3 state of the art production facilities based in and around Bangalore in South India and have the widest Sales and Service set up in sub-continent of India, with overseas offices in Sri Lanka, Bangladesh, Africa, Italy, Egypt etc. Ramsons Equipment and Turkey Solutions have been on the path of sustainable thinking over 5 years.

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BIG BRANDS ARE LEAVING MONEY ON THE CUTTING TABLE

BY RAM SAREEN

Keeping up with consumer demand is a problem for retailers globally. They want products fast, cheap, and well-made, and that pressure trickles down through every part of the supply chain. To cope, vendors have sought out the most efficient production techniques in pursuit of agility, and brands like H&M, Levi's, Marks & Spencer, and VF Corporation have begun to reexamine their quality control standard operating procedures.

To maintain consistent product quality standards, many brands have quality control teams, whose job it is to design, mandate, and audit processes for vendors to follow throughout production. In some ways, these quality control teams are the gatekeepers between the next order from that vendor, and as such, vendors throughout the world must follow brands' quality control manuals, even if the procedures described do nothing to add value.

One example of this is mandatory fabric relaxation. Many fabrics, especially knits, need to be carefully handled to account for stretch that could be warped and affect the overall drape and fit of the final product. But oftentimes before the fabric pieces are sent through the sewing line, the fabric rolls are mishandled during spreading.

"Walk into Sri Lanka, Bangladesh, India, Pakistan, or any country where a lot of these garments are made, and everybody will tell you 'You've got to relax the fabric, this is a mandate,'" explains Ram Sareen, Head Coach and Founder of Tukatech, a fashion technology company. He continues, "This is perfectly alright. Material handling standards are important. But do brands know what that is doing to the final product?"

Typical "relaxation" mandates require that a factory take perfectly rolled fabric, open it onto a table, and leave it there for a day or two to settle. Not only does the handling and friction harm the integrity of the fabric, but now one or two days are lost in the production cycle.

When it is time for production spreading, that fabric is usually handled by at least eight, but sometimes as many as fourteen or fifteen people, who catch and pull the fabric out of proportion as they lay it down. This creates uneven stretch about the fabric, and completely negates any relaxation that might have happened while the fabric was lying in a pile the day before. Factories are following the procedures as they are given,

but sometimes those practices diminish the very quality they are seeking.

The same practices are often applied uniformly across all types of fabric, even if the necessity is not there. For example, fabric handling procedures for knit fabrics may be applied to denim, simply because it is a "stretch" denim. Sareen explains, "The stretch for denim is only in the width. You can relax the denim for ten years and it is never going to come back in the length." These procedures become ingrained in local production culture, at which point changing processes becomes very difficult.

Quality control teams are adept at implementing procedures based on brand policies and manuals but need to assess actual application and effects of those procedures. Sareen states, "Large retailers and brands have been chasing the cheap needle to stay competitive, but now they need to focus attention on implementing more efficient production practices." Have big brands missed the most glaring loss of production resources?

Labor in the above countries is cheap, but labor accounts for less than 20% of the total production cost. The cost of fabric, on the other hand, equates to 60-75% of the garment cost. It is in the best interest of both brands and vendors to focus on handling fabric carefully, so the human and material resources are not wasted, and the number of steps and time for manufacturing is reduced.

Simplifying the fabric spreading process means reduction in the cost of labor, better product quality, and a shorter lead time. "I've seen a team of fourteen maximize their spreading capacity at 2,000 yards," explains Sareen. When fabric spreading is done automatically with a machine, or even on a mechanized trolley system, the capacity increases. "One person using a $1,500 push trolley can spread 4,000-5,000 yards in an eight-hour shift."

What is more, automatic fabric spreading ensures that every inch of fabric is aligned and gently handled from the time the roll is opened, until the pieces are cut and ready for sewing. Automatic fabric spreading machines come with tension-free mechanisms to unwind material from the roll, and constantly monitor the tension during spreading to keep consistent tension throughout the fabric. This means that relaxation for most types of fabric can be reduced or even eliminated from the production process, which saves one or two days, plus the required labor cost, and potential for lost fabric integrity.

In addition to automatic fabric spreading, CAD systems help automate fabric planning and utilization, as well as other pre-production practices. Accounting for fabric shrinkage, for instance, automatically adjusts the piece geometry, even for very tricky

fabrics. Cut-planning applications then run order scenarios to ensure the best lay plans, and nesting algorithms calculate the best utilization of the width of the fabric actually received. Such practices could save three to five days, 20% of staff, and 3-12% of fabric, as well as result in better quality garments.

Sareen explains that even though vendors seem to understand the value of automated cutting rooms, changing the procedures requires external inputs. He witnessed this in a staff meeting at factory recently. "The moment we get into engineering the cutting room, everyone puts their hands up, saying, 'We have to check with our buyer!'" This means that embracing automation must come from the top down. "I think some training needs to be done in the buyers' offices. The brands and retailers need to visit the vendors and see how automation affects the time and quality savings in the cutting rooms and use that knowledge to update their standard operating procedures, like others have begun to do."

It is important to recognize that players at all levels in the supply chain have the same goal: agile production capabilities. Trying to speed up cumbersome processes is like training a bull to do gymnastics: it's just not going to work. Choosing vendors based solely on cheap labor only goes so far in overall cost savings, especially when production methods themselves leave much to be improved.

About the Author

Ram Sareen is the Head Coach & Founder at Tukatech, a fashion technology company that empowers apparel businesses with innovative product development solutions, maximizing productivity from the pattern room to the cutting floor. Contact tukateam@tukatech.com to re-examine the status quo and see where mandated processes can be reshaped with new ideas.

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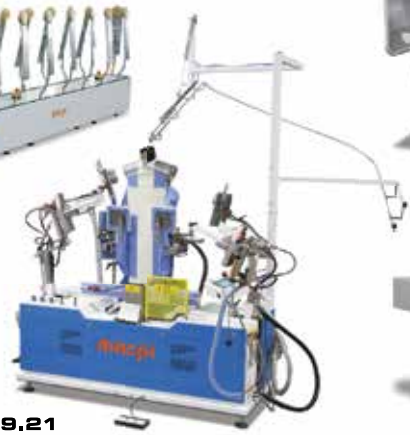

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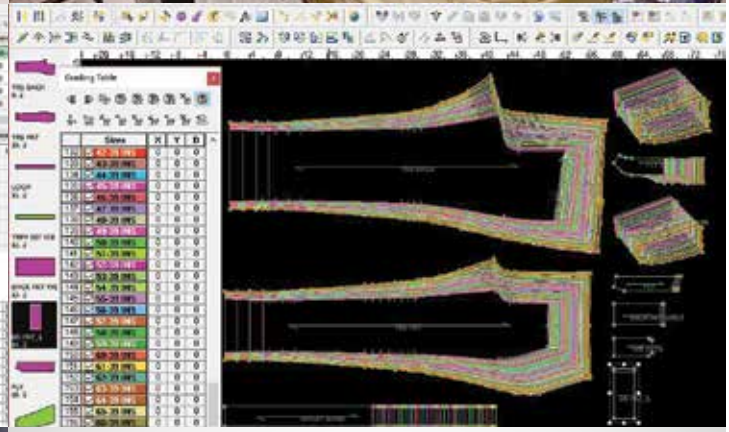

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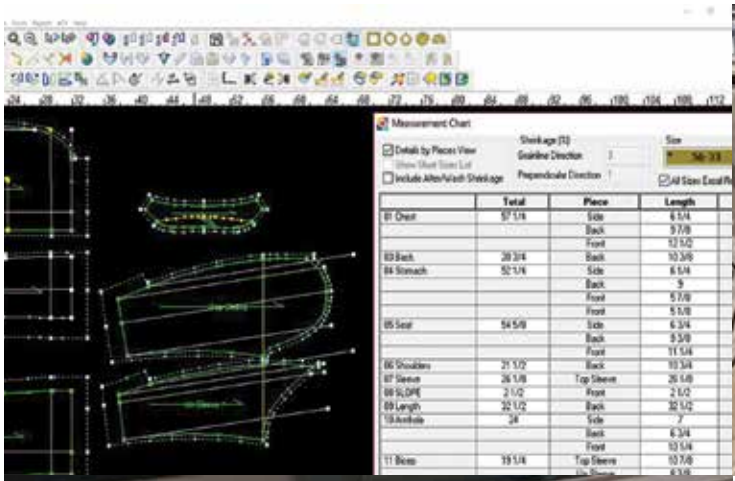

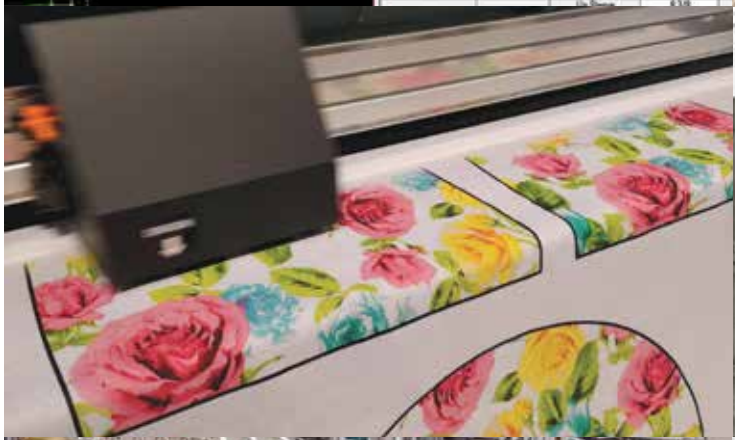

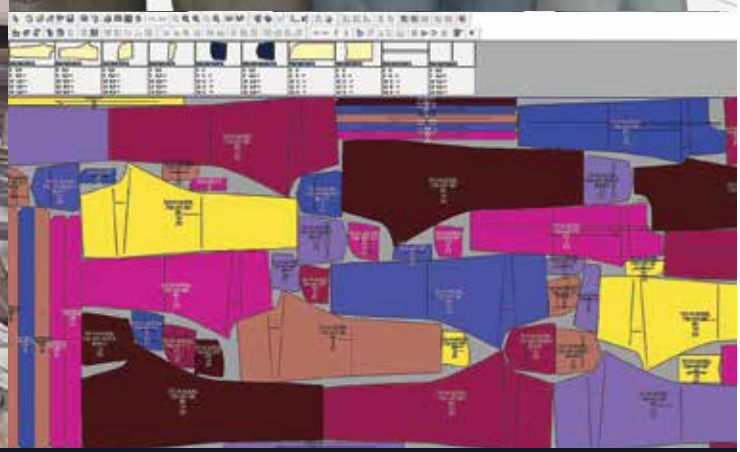

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SEMINAR REPORT 2018: THE ART OF SHIRT MAKING

The Sixth TANTU seminar on **The Art of Shirt Manufacturing** was held on 15th September 2018 at India International Centre, New Delhi. There was an exciting gathering of industry experts, academicians, professionals and Govt. officials from all over India and abroad, discussing on the technical and aesthetic aspects considered at the time of shirt making.

Prabir Jana

Ram Sareen

Dr. Prabir Jana, President, **TANTU** and seminar chairman in his brief welcome address, mentioned the seminar theme was chosen based on audience suggestion – the technology of shirt making – the core apparel area. He explained the uniqueness of the TANTU seminar where information & knowledge is extracted from the experts to maximise value to the audience. An interactive seminar where audience also participate in the discussion. The seminar evolved over the years and this year manufacturing professionals came from Indonesia, Bangladesh, Romania and USA. He also talked about the maiden initiative of TANTU to offer scholarship to two students from it's alma mater to attend the annual seminar, which would help students exposing to the newer knowledge and networking with industry professionals.

Keynote speaker, Dr. Ram Sareen in his keynote address emphasized the fit of the apparel products and on-demand manufacturing. Through some case studies, he shared how global industry is using technology like 3D simulation and pattern printing to shrink the supply chain lead time and to increase the bottom line. He emphasised how the on-demand garment manufacturing and micro factory will be the future business model.

From left Abhishek Tiwari, Sajedur Seraj Prabir Jana, Raveendra Radhakrishna and Kushal Singh Mahar

The first panel discussion theme was **Art of Shirt making** and the panel members discussed some of the features and attributes of shirt and it's functional and aesthetic aspects. The discussion started with the question on what is the purpose of having a pleat at the across back along with the various types of it. For the aesthetic purpose pleats can be added in various ways one example being stitching a box pleat entirely till the bottom. And for functional purpose it helps in providing tolerance for movement as well as function as providing fullness along the across back and the waist of the wearer.

After that it was asked about the number of sleeve pleats used in a shirt. More the number or depth of the pleat, more will be the fullness along the biceps and elbow. If a single pleat is used its position should be in the centre of sleeve slit and half-fold of the sleeve. Along with the pleats, the position of the sleeve placket was also discussed where in, it should

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From left Abhishek Tiwari, Sajedur Seraj Prabir Jana, Raveendra Radhakrishna and Kushal Singh Mahar

Kamaljit Singh

be always be in the centre of the sleeve opening. Any deviation from that will be a technical fault.

For the front placket, the question that was asked was that, if there is a relation between width of the placket and the button distance and how this will it affect the gaping. And it was brought to a conclusion that if the width of the placket is decreased the button distance should also be decreased otherwise there will be a higher chance of gaping. Regarding the gaping of top part of buttonhole placket it was concluded an engineered pattern wherein there would be some difference in the

Finally, a question was asked to the audience, the reason behind a horizontal button hole for the last (the bottom-most) button of the shirt and the answer to was, it has a functional purpose only for a checked shirt where during packing there comes a misalignment of the plackets and the horizontal buttonhole locks the movement of placket.

Kamaljit Singh, business development manager of Freudenberg India, has talked about how interlining makes wearers more comfortable wearing a shirt. They have developed for the specific market segment, an application on a white shirt, where they have developed contamination free interlining with the combination of man-made fibre. It has a high washability without risk of delamination and bubbling. In another product Freudenberg comes up with a patented in adhesive technology, it can be withstood in high washability and can be fused with much lower temperature with high-density polyethene. For dress shirt where it needs a firm looks in collar. It is very little weight interlining, they have gsm range varying from 30-105 it makes collar look good not heavy, day by day collar are getting softer and it gives ease in collar area gives the perfect stretchability.

Mr. Laszlo of **timeSSD** has emphasized the importance of benchmark performance when factories measuring and analysing the productivity and efficiency data. By using timeSSD system, one c an easily establish the standard time of sewing operations without prior training.

Laszlo Szabo

Anshuman Dash

VAN HEUSEN
WOMAN

To estimate the standard time Engineer Don't need to remember code. Engineer just need to choose the correct code depending on the motion, distance and activity.

Mr. Anshuman Dash of **H&H** has talked on the technology they use for fusing machine that can be used for variable thickness. He had highlighted some of the technical features and parameters of a latest fusing machines. He pointed how the fusing machine productivity can be increased by the same fusing machine without compromising the fusing quality.

The second panel discussion was on **Technology of shirt making**. Panel moderator Dr. Prabir Jana started discussion with video presentation and tried to understand of comparative advantages and disadvantages of alternative methods of sewing various shirt components. What is the common industry practice and what the panellists follow and suggest for stitching different shirt components; collar run stitch, collar fusing, pocket attach, side seaming and fusible tape attaching in sleeve armhole.

Efren Pineda of Laguna clothing says they use ready cutting for collars and interlining instead of stitching and trimming the excess fabric. Fabric is expensive, so why one should trim out the fabric and throughout the money by cutting and wasting fabric. They don't use any zig or profile instead collar run stitch is done manually. All the panellist agreed on that zigs for collar run stitch can be used for mass production. For the all fabric types zig can't be used. Zig are mostly used in making casual shirts. Further panellist added as the collar shape is not flat, to get the correct collar shape human hand needed.

When collar is fused with a fusible interlining, what is best direction feeding collar -is it grain direction, off-grain or diagonal direction? Some panellists suggest collar direction does not matter at all in fusing quality. If all the four fusing parameters are maintained all the time when collar is passing through the machine. Sri from Veit pointed out that diagonal feeding of collars would give better result.

What is correct way of attaching the chest pocket in the front panel? Almost all panellist agreed in starting pocket stitching from front placket side as it would easier for aligning pocket and matching patterns. In practice some shirt makers start sewing pocket from the side seam. Why so? Dr. Jana answered the question - anti-clock wise rotation of a garment component while stitching is natural motion. Following that natural habit of human, pocket stitching should be started from armhole side.

Sri Ramaswamy of **Veit** enriched audience by sharing the garment fusing technology and the possible solutions of many common problems we face during fusing garment components. He further emphasized how the Veit fusing machine can help in reducing unnecessary power consumption when machine is not in use. A

From left Efren Pineda, Didit Handoyo, Prabir Jana, Gurucharan Kaup and Nitin Sharma

From left Roopak Malik, Gaurav Kumar, Ila Saxena, Mridul Dasgupta and Pallab Banerjee

control panel ensure the fusing machine only run when machine temperature reach to a the desired one to achieve the best fusing quality in all garments. Fusing machine records breakdown time and maintenance time.

The final panel discussion on "the business of shirt making" started focusing on the matter, that how in spite of India excelling in fabric, garment production and technology, it has not come up as a prominent place in shirt making industry and how the change in market dynamics from large orders to small orders with various fashion elements have affected the industry.

Sri Ramaswamy

In reply to that the most prominent answer did not came in favour of India's production as from the beginning there has been a lag in interest in shirt making. Adding to that, most of the manufacturers don't have that level of commitment to the buyers and then comes the costing. In present day it has become like impossible to compete with the costing provided by Bangladesh's manufacturers. Mr Roopak Malik, Director, Textile Sourcing Limited totally blamed the delivery system of orders along with the costing. Mr Gaurav Kumar, marketing director of Aquarelle added the problem with the mind-set of the export house where in they think of only individual order profit and not think of having a long-term relation with the buyer. Mr Mridul Dasgupta, GM of Macy's merchandising group believes that value addition and design driven production is India's strong hold and no other countries can compete with India. It was also discussed about the problems faced by the Indian manufacturers in scaling up the production system for shirts. Along with that Mr Pallab Banerjee, Strategic Advisor of Pearl Global also discussed about strategic sourcing and what advantages it may upon its implementation.

Thus concluding to it we have missed the chance of becoming a very strong textile value chain but with product development, change of mind set we can make a mark in this business and again it will not be possible without proper commitment from the industries, but then then again lies the big question "Do we really want to get into business of shirt making?"

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Seminar on
"It's in Your Jeans "
India International Centre, New Delhi
14th September 2019

Registration **09:30 Hrs – 10:00 Hrs**

Inaugural Session **10:00 Hrs – 10:30 Hrs**

Welcome Speech by Prabir Jana, President, TANTU
Launching of Annual Journal of TANTU 2019
Chief Guest Address by Sunder Belani, Managing Director, Ramsons India
Keynote Speech by Subir Mukherjee, Business Head, Bhaskar Industries

Panel Discussion: Denim Fabric Development: Art or Science **10:30 Hrs – 11:30 Hrs**

Moderator: Prabir Jana, Professor, NIFT, New Delhi

Panelist:
Abhijit Ghosh, Managing Director, Mak Gameplan Enterprise, India
Munir Syed Sayeed, Chief Operating Officer, Epyllion Group, Bangladesh
Mr. Jasim Uddin, Director, NX Denim, Bangladesh
Subrata Ghosh, Vice President, Chiripal Industries, India

Tea Break **11:30 Hrs – 11:45 Hrs**

Presentation by Veit-Ramsons, India **11:45 Hrs – 12:05 Hrs**

Presentation by Tukatech, Asia **12:05 Hrs – 12:25 Hrs**

Panel Discussion: Finishing Jeans: Environmental Reboot **12:25 Hrs – 13:25 Hrs**

Moderator: Suvodeep Mukherjee, Sr General Manager,
TUV SUD South Asia Private Limited

Panelist:
Manuj Kanchan , General Manager, Jeanologia, South Asia
Dipankar Bose, Implementation Manager, ZDHC, South Asia
Kishan Daga, Business Leader, Triburg Sportswear, India
Aseem Chitkara, Vice President, Marketing, Ginni International, India

Presentation by Fortuna Colours **13:25 Hrs – 13:45 Hrs**

Presentation by Datatex **13:45 Hrs - 14:05 Hrs**

Networking Lunch **14:05 Hrs – 14:45 Hrs**

Presentation by Macpi **14:45 Hrs – 15:05 Hrs**

Presentation by SipItaly **15:05 Hrs – 15:25 Hrs**

Presentation by AMA Herbal **15:25 Hrs – 15:45 Hrs**

Panel Discussion - Start Up in Blue Space **15:45 Hrs – 16:45 Hrs**

Moderator: Pranav Khanna, Builder at X, India

Panelist:
Shyam Sukhramani, Founder KORRA Jeans, India
Sartaj Singh Mehta, Chief Product Officer at BigPhi (Turms), India
Sanjay Goel, Founder and CEO, Srishti Technet Private Limited, India
Padma Raj Keshri, Curator, India
BS Prasad, Founder, Indigenous, India

Vote of Thanks: Kingshuk Pandit, Vice President, TANTU **16:45 Hrs - 16:50 Hrs**

Networking Tea **16:50 Hrs – 17:30 Hrs**

LIST OF POPULAR DENIM MANUFACTURERS IN INDIA

Sl. No.	Name of company	ADDRESS	EMAIL	CONTACT NUMBER
1	AARVE DENIMS & EXPORT LTD.	191 Moje Shahwadi, Narol-Sarkhej Highway, Nr. Old Octroi Naka, Narol, Ahmedabad-382 405. Gujarat, India.	Info@aarveedenims.com	9825600689, 796814700
2	ANUBHA INDS. PVT. LTD.	Plot No - 369, 371, 377 - NH8, Village & Taluka Palsana, Surat - 394 315, Gujarat - India.	akshat@anubhaindustries.com	7698005599
3	ARVIND MILLS LTD.	Naroda Road, Gujrat, India-Ahmedabad-380025.	rv.bhimani@arvind.in	7968268000
4	ASHIMA LTD.	Nr. Anupam Cinema, Khokhara, Ahmedabad – 380 02, India.	texcellence@ashima.in denim@ ashima.in	7967777000/ 7922773061
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6	ETCO DENIM PVT. LTD.	142, Andheri Industrial Estate, Nr Janki Centre, Off. Veera Desai Road, Andheri (west) Mumbai - 400 053.	Info@etco.in	42382800/49
7	GINNI INTERNATIONAL LTD.	SP2- (1A) & (2) RIICO Industrial Area, Neemrana, Dist: Alwar (Rajasthan) INDIA.	fabricmktg@ginniint.com	+911494246 069
8	JINDAL WORLDWIDE LTD.	207, Saijpur Gopalpur, Opp. Lane of Piplaj, Narol Octroi Naka, N.H. 8, Ahmedabad - 382 445, Gujarat, INDIA.	Info@jindaltextiles.com	7971001500, 7925735600
9	K.G.DENIM LTD.	KG Denim Limited, Then Thirumalai, Coimbatore – 641302, India	customercare@kgdenim.in	4254235401
10	K.G.FABRIC LTD.	Sri Kannapiran Mill Premises, Sowripalyam, Krishna Colony Extension, Coimbatore, Tamil Nadu 641028	enquiry@kgfabriks.com	4222351111
11	LNJ DENIM (UNIT RSWM LTD)	LNJ Nagar Village Mordi | PB No. 28, Distt- Banswara(Rajasthan) – 327001.	mktg.denim@lnjbhilwara.com	2961231661
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13	MAFATLAL INDUSTRIES LTD.	Vejalpore Road, (near Railway Station), Navsari-396445, Gujarat, India.	contact@mafatlals.com	22-67713800/3900
14	MALWA INDUSTRIES LTD.	Pacific Square, III Floor, Sector 15, Part-II, Sector 15, Gurugram, Haryana 122001	mktg.denim@malwagroup.com	91161-2229146
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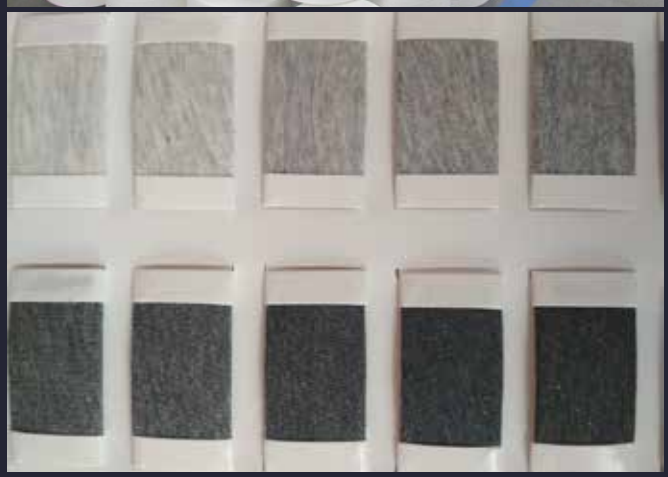


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28	SOMA TEXTILE AND INDUSTRIES LTD.	Rakhial Road, Ahmedabad – 380 023. GUJARAT (INDIA).	fabrics@somatextiles.com	079 2274 3285
29	CENTURY TEXTILE AND INDUSTRIES LTD.	Century Bhavan, Dr Annie Besant Road, Worli, Mumbai 400030, Maharashtra, India.	ctil.ho@birlacentury.com	2224957000
30	Spykar Jeans	Lotus Corporate Park, 19th Floor, A wing, Ram Mandir Lane, Jai Coach Junction, Off Western Express Highway, Goregaon (East), Mumbai - 400 063	customerservice@infibeam.me	22-42175300 / 42101992

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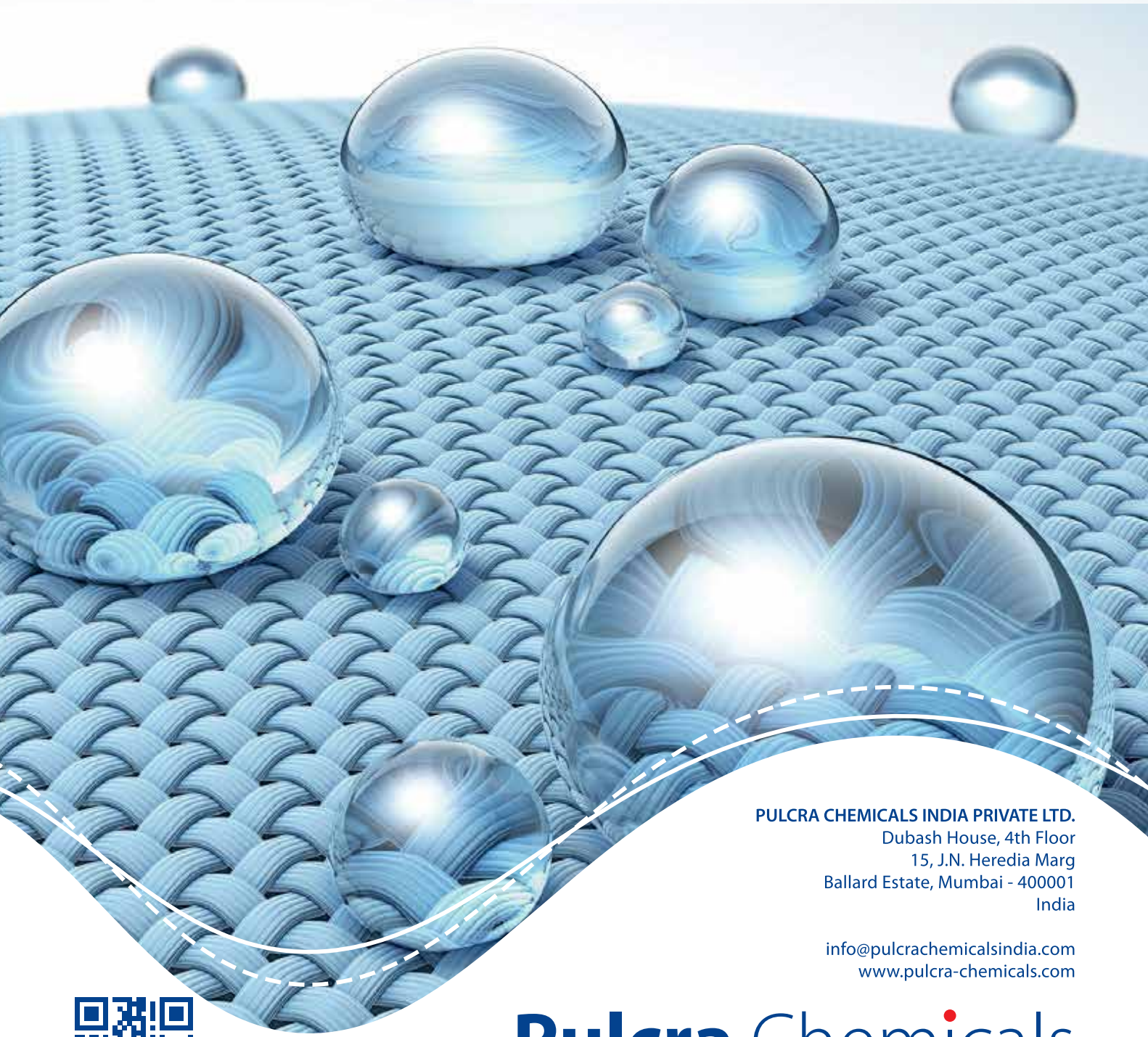

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