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Analyze the Properties of Woven Fabric Manufactured by Hand Loom and Power Loom

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ABSTRACT: *The handloom weaving industry is one of the ancient cottage industries in Bangladesh. Next to agriculture, it is the second largest sources of rural employment and income. The present study is an effort to investigate the present scenario of handloom weaving industries in Bangladesh. Also the analysis the properties and present trends of local woven fabric manufactured by Hand loom and Power loom. The study is based on secondary data.*

KEYWORDS : *Fabric Properties, GSM, Count, Dimensional Stability, Color Fastness, Wash Fastness*

I. INTRODUCTION

The The handloom weaving industry is one of the ancient cottage industries in Bangladesh. Next to agriculture, it is the second largest sources of rural employment and income. The present study is an effort to investigate the present scenario of handloom weaving industries in Bangladesh. The study is based on secondary data. The data used in this study were collected from different sources such as books, reports, journal articles, newspaper and online sources. Collected data have been analyzed through tabular, graphical and statistical method. The study found that in Bangladesh there are about 183512 handlooms weaving units with about 505556 looms. The total operational looms are 311851, which are 61.7 percent of total looms, and the rest 193705 looms are non-operational. The study also found that handloom weaving industry is a promising sector to provide rural employment in the perspective of Bangladesh. Handloom sector is contributing to generation rural employment and income increase, alleviating rural poverty, substituting imports, and increasing potentials for exports. Another important finding is that this sector provides employment for the women labor force at family environment. At present, a significant portion of local demand for fabric is met-up by handloom industries. Therefore, government should take proper care for the development of the handloom industries.[i]

II. HISTORY OF HANDLOOM

In the annals of Indian handloom saree, Shantipur and Fulia are a name to reckon with. Their fascinating story is also in a nutshell the story of Bengal handloom sarees. The geographical twins could not be more different. The first, a handloom weaving centre over 500 years old. The second came to flourish only after Partition. Yet, their destinies are linked together – the Shantipur and Fulia saree swim or sink with the success or otherwise of Bengal handloom.There are records of handloom saree weaving activity in Shantipur, a centre of Vaishnavite culture and Bhakti movement, as early as the 15th century. Weaving flourished throughout the medieval era, and the famed indigo-dyed Neelambari made the Shantipur saree a household name.There was a strong sense of identity among Shantipur weavers. They united to agitate against the stranglehold of the Dadni system of the British East India Company and even took their grievances to colonial courts during the19th century.In the decades leading up to independence, Shantipur saw gradual inflow of techniques like the Barrel Dobby facilitating the conversion from Throw Shuttle to Fly Shuttle (1920s), the Jacquard Machine (1930s), and sectional warping and sizing that allowed production of warp yarns 350 yards long (1930s).

Important Products with Places of Production

Sl.	Name of the Products	Place of Production
1	Jamdani	Rupgonj and Sonargaon of Narayangonj district.
2	Benarasi	Mirpur of Dhaka, Iswardi of Pabna district and Gangachara of Rangpur district.
3	Tangail Sharee (Cotton sharee, Half Silk, Soft Silk, Cotton Jamdani, Gas-mercerised twisted cotton sharee, Dangoo sharee, Balucherri)	Tangail Sadar, Delduar and Kalihati, Nagorpur, Basail of Tangail District.
4	Handloom Cotton share	Shahjadpur, Belkuchi and Sadar of Sirajgonj district, Narsingdi and Pabna districts.
5	Lungi	Ruhitpur of Keranigonj and Dohar of Dhaka district,Shahjadpur,Ullapara, Belkuchi, Sadar of Sirajgonj district,Kumarkhali of Kushtia district, Sathia,
6	Silk share	Sadar and Shibgonj of Chapai Nawabgonj and Rajshahi district.
7	Gamcha	Ullapara,Kamarkhand of Serajgonj, Gouranadi of Barisal, Fultola,Doulatpur of Khulna,Jhalokathi, Jessore and Bogra districts.
8	Check Fabrics	Belkuchi of Sirajgonj district.
9	Bed Sheet & Bed Cover	Kumarkhali of Kustia district, Danga of Narsingdi district.
10	Sofa Cover	Danga of Narsingdi district.
11	Rakhine Special Wear(Wooling Shirting, Woolen Bed Sheet, ladies chadar, Bag,Lungi and Thami for tribal ladies)	Taltoli of Borguna district, Kalapara, Rangabali of Patuakhali district and Cox's Bazar district.
12	Tribal Fashion Wear (Thami for tribal ladies, Khati(Orna), Ladies Chadar & Lungi.	Rangamati, Khagrachari & Bandarban Hill districts.
13	Miniouri Fashion Garments (Monipuri Sharee, Punek for ladies like lungi, Lungi, Un-stitched cloth (three pieces), Innachi(Orna) & Vanity Bag	Sylhet and Moulivibazar districts.[ii]

[Source: Bangladesh Handloom Board, http://www.bhb.gov.bd/productionPlaces.php]

III. PRESENT SCENARIO OF HANDLOOM

Handloom sector in Bangladesh consists of more than 0.505 million Handlooms and 1.0 million Handloom weavers. But only 0.3 million looms are active (59% of existed looms) and that provides around 620 million meters of fabric (about 40% total demand of the population) annually. About more than 1.5 million people are directly and indirectly involved for their livelihood. (http://www.bhb.gov.bd/; visited on 17th July'10). Handloom industry is the biggest handicraft industry in our country; it is the second largest source of rural employment after agriculture (Ahmed, M.U 1999). The knowledge and skills needed for this sector transformed from their forefathers. Thus, the cottage-based industry has been build up by inheritance. Handloom fabric is more producer-driven than buyer-driven. An international experts study reveals that the technical skill of the weavers of Bangladesh is second to none in the world (i.e. Dhaka muslin products, the finest cotton fabric). Handloom products are best known for their eco-friendly nature. The world is solely concentrating on 'green technology', therefore 'green products' and 'social business concept' to save the struggling world, where 'Handloom technology' could be best 'green technology' to fulfill basic needs of human i.e., clothing. The Handloom sector has a great deal of potential for further value addition in the RMG sector for further meeting local needs of fabrics and expanding sales of its products directly in foreign countries. This sector is an important channel for balanced sustainable economic growth. (The Financial Express, dated on 5th Dec'07 'Giving Support to Handloom Sector'). Handloom weavers and workers are generally poor. Vitality of

Handloom Industry can lead to improvement in the earning of those people on a large scale who are at the fringes of social existence by alleviating their poverty. This sector can be a source of employment of hard-passed rural people, particularly.Since long the Handloom and its weaving Industry have been struggling; though the government and Non-government sectors have been providing supporting initiatives to the cottage-based industry. The objective of paper is to apply 'Adoption and Diffusion of Innovation Theory' to active idle looms and bring back weavers and stakeholders of the industry.

IV. RAW MATERIAL USED

Bangladesh has remained a net importer of yarn at least since 1947. Almost all yarns are imported; warp silk from China, cotton from China and India. Some local silk and cotton can be used for weft. Jute, which is locally grown and an important agricultural crop, has a lot of potential, especially the softer material developed in the Norad project as well as blends. The Jute Research Institute has made an interesting 40 %jute/60 % cotton yarn. Jute/silk experiments – silk warp and jute weft - have also been conducted, showing that a softer jute yarn is needed. One textile designer claims that "Interesting yearns are made only for exports." Thin yarns for the handloom industry are machine spun. Hand spun cotton is used in the fabric called "khaki", a thicker cotton quality. Linen also has to be imported and is too expensive to be used in any quantity. Synthetic dyes are imported. Natural dyes, except madder, which has to be imported, are grown locally. Some international designers using the Pantone color system face problems, because they do not take the availability of dyes and the working process of the dyers into consideration.

V. PRESENT PRODUCT OF HANDLOOM

The handloom is simply a weaving device made of wood and iron mainly operated by hand ,relying solely on human metabolic energy. It requires a space barely 8 sq. metres. Handloom weaving is a cottage based industry spread through out the country. The sounds of the handloom is the music of the rural home inviting fortune to them. In the process of weaving the handloom weaver create a harmony of motion and rhythm. The vast majority of Bangladeshi handlooms are engaged in weaving cotton and blended fabrics although handloom cloth of silk earned a good reputation. Famous areas for silk weaving are Rajshahi, Tangail and Nobabgonj . Rajshahi produces mainly silk sarees, a special type of cloth weared by the women folk . Tangail produces also silk saree namely Tangail Muslin and Narayangonj produces the famous Jamdani saree, silk sarees Tangail Muslins and famous jamdani. Zari work called brocade is also famous in Mirpur, Dhaka .In Bangladesh there are different schools of weaving on jacquard, dobby, frame and pit looms .Product assortments made of other are saree , lungie, gamsa, grameen check fabrics, printed bed covers, pillow covers, table mats, kitchen and hand towels, apron, curtain and upholstery, furnishing fabrics, bags bandage etc.

VI. POWER LOOMS DEVELOPMENT

Edmund Cartwright built and patented a power loom in 1785, and it was this that was adopted by the nascent cotton industry in England. The silk loom made by Jacques Vaucanson in 1745 operated on the same principles but wasn't developed further. The invention of the flying shuttle by John Kay was critical to the development of a commercially successful power loom.[8] Cartwright's loom was impractical but the ideas were developed by numerous inventors in the Manchester area in England, where by 1818 there were 32 factories containing 5732 looms. Horrocks loom was viable but it was the Roberts Loom in 1830[10] that marked the turning point. Before this time hand looms had outnumbered power looms. Incremental changes to the three motions continued to be made. The problems of sizing, stop-motions, consistent take-up and a temple to maintain the width remained. In 1841, Kenworthy and Bullough produced the Lancashire Loom[11] which was self-acting or semi-automatic. This enables a 15-year-old spinner to run six looms at the same time. Incrementally, the Dickinson Loom, and then the Keighley born inventor Northrop working for the Draper Corporation in Hopedale produced the fully automatic Northrop Loom which recharged the shuttle when the pirn was empty. The Draper E and X model became the leading products from 1909 until they were challenged by the different characteristics of synthetic fibres such as rayon. From 1942 the faster and more efficient shuttleless Sulzer looms and the rapier looms were introduced. Modern industrial looms can weave at 2000 weft insertions per minute. Today, advances in technology have produced a variety of looms designed to maximize production for specific types of material. The most common of these are air-jet looms (e.g. "JAT710") and water-jet looms

VII. METHODOLOGY AND ANALYSIS OF RESULT

To judge fabric performance we have to work with the following parameter:

[1] Color fastness to washing
[2] Color fastness to rubbing
[3] Tensile strength
[4] Dimensional stability
[5] Abrasion resistance
[6] Count
[7] GSM

Color Fastness to Washing: Color fatness to washing means, A specimen of the textile, in contact with one or two specified adjacent fabrics, is mechanically agitated under described conditions of time and temperature in a soap solution, then rinsed and dried. The change in color of the specimen and the staining of the adjacent fabric are assessed with the grey scales

A composite specimen is agitated in a wash- wheel using one of the sets of conditions shown in Table. The sample is then dried and assessed for color loss and the adjacent fabric is assessed for staining.

Test	Liquor	Temperature	Time in minute	Reproduces action of
C01	0.5% soap	40	30	Hand Washing
C02	0.5% soap	50	45	Repeated hand washing
C03	0.5% soap 0.2% soda ash	60	30	Medium cellulosic wash, Several wool wash.
C04	0.5% soap 0.2% soda ash	95	30	Several cellulosic wash.
C05	0.5% soap 0.2% soda ash	95	240	Very several cellulosic wash.
C06	4g/l reference detergent + perborate	Various	Various	Domestic laundering.

Recipe:

Sodium Perborate……..1 gm/litre
ECE Phosphate……..4 gm/litre

Sample Preparation:

Sample Fabric……..10 cm X 4 cm
Multi fiber fabric……10 cm X 4 cm

Working Procedure:

Collecting the sample from bulk and then conditioning for 04.30 to 06 hours
↓
Making a specimen of 04 cm*10 cm in size.
↓
Sewing the specimen with multi-fibre fabric of same size at one corner.
↓
Making the solution of 4gm/litre ECE detergent & 1 gm/litre sodium perborate, (If required SKFL use 0.15 gm/litre TAED).
↓

Putting the specimen with multi-fibre fabric into the solution in Rotawash m/c
Prog.: C2S Temp.: 60OC/ 40OC Time: 30 min Still ball: 25 pcs
↓
Rinsing with hot water respectively.
↓
squeezing with cold water of the sample is done (Hand Wash).
↓
then drying is done at a temperature in the air not exceeding 60OC
↓
the stitching is then broken out except on one of the shorter end.
↓
Measuring the staining and color change by grey scale & make a test report.

Result of Color Fastness to Washing:

Sample Fabric	Change Value		Staining Value	
	Numerical Value	Remarks	Numerical Value	Remarks
1.Lungi (Power Loom)	4	Good	4	Good
2.Lungi (Hand Loom)	2	Fair	2	Fair
3.Gamsa (Power Loom)	4	Good	4	Good
4.Red Gamsa (Hand Loom)	2	Fair	2	Fair
5.Green Gamsa(Hand Loom)	4	Good	4	Good

Note: *Here we can't find the sample of same count and same structure of power loom as well as hand loom, so the expected result can't be shown.*

Color Fastness to Rubbing: This test is designed to determine the degree of color which may be transferred from the surface of a colored fabric to a specify test cloth for rubbing (which could be dry and Wet).

Sample Preparation:

Sample Fabric -------- 14 cm X 5 cm pieces

Test Procedure of Color Fastness to Rubbing:

Lock the test specimen (textile sample) onto the base of the crock meter.
↓
Using the spinal clip, set 5 Cm * 5Cm of the white cotton fabric to the finger of the crock meter.
↓
Lower the covered finger on the test sample.
↓
Turn hand crank at the rate of the one turn per second.
↓
Remove the white rubbing test cloth and e valuate with grey scale.

Result of Color Fastness to Rubbing: In this stage compare the contrast between the treated and untreated white rubbing cloth with grey scale and rated 1 to 5.

Sample Fabric	Staining Scale	
	Dry	Wet
1.Lungi (Power Loom)	5	4/5
2.Lungi (Hand Loom)	3	2
3.Gamsa (Power Loom)	5	4
4.Red Gamsa (Hand Loom)	4/5	3
5.Green Gamsa(Hand Loom)	3/4	2/3

Note: *Here we can't find the sample of same count and same structure of power loom as well as hand loom, so the expected result can't be shown.*

Tensile Strength: Tensile strength means the material under tensile stress in the largest deformation of homogeneous material stress.Tensile strength of textile testing methods are: 1 inch grasp like law, like law in Article 2 inches, 1 inch sample method, elongation at break,Material tensile strength is the maximum uniform plastic deformation of the stress.

a. In the tensile test, the specimen until fracture suffered the biggest so far is the tensile strength of tensile stress and the results expressed in MPa. Some call it the wrong tensile strength, tensile strength and so on.

b. Instruments like the tensile strength tests can be obtained tensile fracture stress, the tensile yield stress, elongation at break data.

c. The calculation of tensile strength:
σt for tensile strength (MPa); p for the peak load (N); b for the specimen width (mm); d is the sample thickness (mm).

Sample Preparation: Sample Fabric --- 6''x4''

Result of Tensile Strength:

Sample Fabric	Tensile Strength
1.Lungi (Power Loom)	11.00 Kg
2.Lungi (Hand Loom)	14.10 Kg
3.Gamsa (Power Loom)	12.90 Kg
4.Red Gamsa (Hand Loom)	08.80 Kg
5.Green Gamsa(Hand Loom)	07.60 Kg

Note: *Here we can't find the sample of same count and same structure of power loom as well as hand loom, so the expected result can't be shown.*

Dimensional Stability: A measure of the dimensional change of a material that is caused by factors such as tem Dimensional stability refers to a material's ability to maintain its size and shape when subjected to environmental variables such as thermo cycles of hot and cold or humidity changes and the result of polymerization or setting premature changes, humidity changes, chemical treatment, and stress exposure.

Procedure of Dimensional Stability Test: Dimensional stability test is an off line quality assurance system. By this test, we can be confirming about the shrinkage and spirility properties of a fabric. After dyeing and finishing operation; dimensional stability test is carried out. Dimensional properties can be changed by stentering, compacting or by treating the fabric with finishing chemicals.
Sample: Two piece of 11 cm x 11 cm fabric is taken for test.

Procedure:

- Conditioning: Put the sample in the table for 4 hours for conditioning before starting test.
- Cut the sample 11 x 11 cm & benchmark should be 10 x 10 cm. Stitch the sample (3 sides) by over lock

sewing machine.

- Put sample in washing machine and run according to buyer's choice.
- Drying: All Buyers' requirement is tumble Dry except ECHO SCOURING is flat dry.

Calculation: Shrinkage (%) = (Before wash – After Wash) / Before Wash x 100
Expansion (%) = (After wash – Before wash) / Before wash x 100

Results of Dimensional Stability:

Sample Fabric	Shrinkage (%)		Expansion (%)	
	Warp way	Weft way	Warp way	Weft way
1.Lungi (Power Loom)	10 %	3 %	--	--
2.Lungi (Hand Loom)	5 %	1 %	--	--
3.Gamsa (Power Loom)	13 %	15 %	--	--
4.Red Gamsa (Hand Loom)	0 %	0 %	--	--
5.Green Gamsa(Hand Loom)	5 %	0 %	--	--

Note: Here we can't find the sample of same count and same structure of power loom as well as hand loom, so the expected result can't be shown.

Pilling Test: Pilling is a fabric surface characterized by little pills of entangled fiber clinging to the cloth surface and giving the garment unsightly appearance. The pills are formed during wear and washing by the entanglement of loose fibers which protrude from the fabric surface. Under the influence of the rubbing action these loose fibers develop into small spherical bundles anchored to the fabric by a few unbroken fibers.

Procedure of Pilling Test: Martindale abrasion tester may be used for pilling test of any fabric. The normal samples holders are replaced with light weight square holders, which are keyed so that they may have vertical movement but cannot turn on their axes. The samples are given a multi directional movement and rubbed against a standard fabric. After certain number of rubs, the samples are examined and the number of pills counted. This may be repeated say in stages of 500 cycles up to 3000 or 5000 and the rate of development of pills noted. The abrading materials may be 15 oz. cotton canvas or the test materials itself. The test specimens are mounted on the rectangular blocks. One and half inch * two and half inch and after a given number of rubs, the number of pills is counted.

Scale and Counting:

No of Pill	Standard Ratio	Remarks
0 – 4	5	Very Good
5 – 10	4	Good
11 – 20	3	Fair
21 – 40	2	Moderate
41 – 60	1	Bad
>60	0	Very Bad

Note: *Here we can't find the sample of same count and same structure of power loom as well as hand loom, so the expected result can't be shown.*

Sample Preparation:

Sample Fabric Size------ 140 mm X 140 mm

RESULTS OF PILLING TEST:

Sample Fabric	No of Pill	Numerical Value	Remarks
1.Lungi (Power loom)	4	5	Very Good
2.Lungi (Hand Loom)	35	2	Moderate
3.Gamsa (Power Loom)	5	4	Good
4.Gamsa (Hand Loom)	16	3	Fair

Note: *Here we can't find the sample of same count and same structure of power loom as well as hand loom, so the expected result can't be shown.*

Count: Count is a numerical expression which indicates the fineness or coarseness of yarn. A definition is given by textile institute, "count, a number indicating the mass per unit length or length per unit mass of yarn".

Sample Fabric	Count (Ne)	
	Warp	Weft
1.Lungi (Power Loom)	54	74
2.Lungi (Hand Loom)	23	21
3.Gamsa (Power Loom)	9	8
4.Red Gamsa (Hand Loom)	25	20
5.Green Gamsa(Hand Loom)	35	23

Note: *The term count variation is generally used to express variation in the weight of a lea and this is expressed as C.V. %. The number of samples and the length being considered for count checking affects this. While assessing count variation, it is very important to test adequate number of leas. After reeling the appropriate length of yarn, the yarn is conditioned in the standard atmosphere for testing before its weight is determined.*

GSM: The GSM of fabric is one kind of specification of fabric which is very important for a textile engineer for understanding and production of fabric. 'GSM' means 'Gram per square meter' that is the weight of fabric in gram per one square meter. By this we can compare the fabrics in unit area which is heavier and which is lighter.

Procedure: The weight of a fabric can be expressed in two ways, either as the 'weight per unit area' or the 'weight per unit length'; the former is self explanatory but the latter requires a little explanation because the weight of a unit length of fabric will obviously be affected by its width. In woven fabric, the weight per unit length is usually referred to as the 'weight per running yard'. It is necessary therefore to know the agreed standard width upon which the weight per running yard is based. Usually this width depends upon the width of loom. Before coming the term 'GSM' there was another term called 'lb/100 yards'. This expression is used by British Standard. For measuring this there are a template and a quadrant balance. The template area is 1/100 square yards of which each arm is 1/10 yards in length. For measuring GSM, a GSM cutter is used to cut the fabric and weight is taken in balance. Both of these measurement and method is equally used for both woven and knitted fabrics.

Sample Fabric	**GSM**
1.Lungi (Power Loom)	92
2.Lungi (Hand Loom)	105
3.Gamsa (Power Loom)	170
4.Red Gamsa (Hand Loom)	75
5.Green Gamsa(Hand Loom)	93

VIII. COMPARISON

Test	Hand loom						Power loom			
	Lungi		Red Gamsa		Green Gamsa		Lungi		Gamsa	
1. Color fastness to washing	2		2		4		4		4	
2. Color fastness to rubbing	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
	3	2	4/5	3	3/4	2/3	5	4/5	5	4
3. Tensile strength	14.10 Kg		08.80 Kg		07.60 Kg		11.00 Kg		12.90 Kg	
4. Dimensional stability	Warp way	Weft Way	Warp way	Weft Way	Warp way	Weft Way	Warp way	Weft Way	Warp way	Weft Way
	5 %	1 %	0 %	0 %	5 %	0 %	10 %	3 %	13 %	15 %
5. Abrasion resistance	Moderate		Fair		Fair		Very Good		Good	
6. Count	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
	23	21	25	20	35	23	54	74	9	8

By considering above data we can say that the power loom product has much more acceptable quality than the hand loom product .For this reason we are going towards the power loom production today. Now a day's most of the hand looms are replaced by the power loom.

IX. CONCLUSION

The importance of the textile industry in the economy of Bangladesh is very high. Furthermore, the industry is expected to be the catalyst in the industrialization of Bangladesh, and has been declared as a thrust sector by the government. However, over the course of my Senior Project investigations, I have realized that Bangladesh's low labor cost, skill development potential, a presently expanding market, and favorable conversion cost can be used to turn the challenges of the quota-free market into a window of opportunity. In addition, most developed countries are turning away from industries like the textile industry and investing in other sectors, thus creating a vacuum in the market. There is currently a serious lack of coordination among the various government agencies that are connected in some way with the textile industry.

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