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Washing Defects and Remedial Actions of Denim Garments and Statistical Review of Denim Sectors in Emerging Economy

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ABSTRACT

This paper aimed to identify the washing defects of denim garments and the remedies for these washing defects of denim garments in Bangladesh. The other purpose of this paper is to explain how such errors are related to the waste, production, and production costs of denim clothing. It also provides a statistical review of the denim sector in Bangladesh as compared to other countries. This paper is conveyed based on theoretical and statistical. It appears washing defects of denim garment, and their remedial actions and reveals the effect of washing defects on wastage, production, and production cost of denim garments. This research paper shows more washing defects of denim garments in Bangladesh. The statistical review displays that Bangladesh is exporting denim products nearly 200 million pieces every year over the world and ranks as the second-largest denim garments exporter after China. By studying this paper, the manufacturer of denim garments in Bangladesh and other countries will be conscious of these defects and able to minimize these defects that will help improve the economy all over the world.

1. Introduction

The textile and garment has a significant role in economic development in Bangladesh by exporting these products [6]. Bangladesh gross domestic product (GDP) increased from \$6.29 billion to \$286 billion from 1972 - 2019, where \$41 billion was generated by exporting, and surprisingly around 84% comes from exporting textile and garment goods (World Bank 2019). Denim garments are one of the most necessary parts of the textile sector in Bangladesh. Denim garments is a family-wearable dress for all ages and have become textile and apparel products. Denim garments are produced from denim fabrics, which are one of the oldest fabric

types in the world and can always remain young as a result of years of intensive product development activities [2]. The exterior appearance of denim garments is one of the strongest aspects of its quality [1]. The most necessary operation for denim fabric products is the washing operation [7]. The main purpose of washing denim clothing is to enhance the feeling, appearance, and better look of the final product. The most important operation for denim fabric products is the washing operation [7]. Many defects appeared to us in denim manufacturing sectors in Bangladesh during the washings. The rising of washing defects affects the whole process of denim garments manufacturing.

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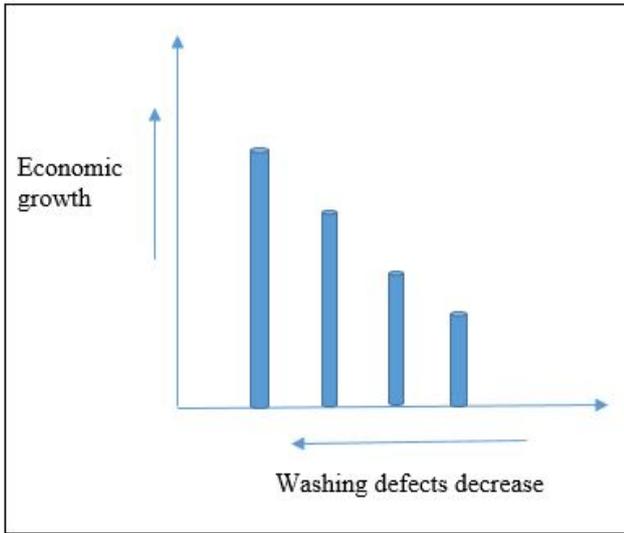


Figure 1. When washing defects decrease

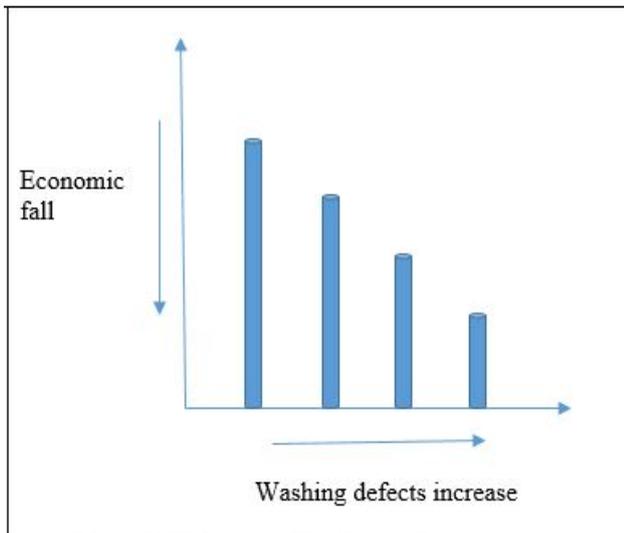


Figure 2. When washing defects increase

In Bangladesh, denim washing defects increase wastages of raw materials and other equipment's which is related to denim production. Similarly, this defect reduces the production of denim garments, which affects the production cost and price of the final products. As a result, the production cost of the final denim products also increases. As the production cost increased due to denim washing defects. So, the price of the final denim goods will increase automatically. Finally, for this contention, the consumer will give more money for final goods of denim garments, which affects the total financial cycle or system in Bangladesh. If denim washing defects don't be found during denim washing, and then it will help the economic growth of whole production (shown in Figure 1). Whereas, if denim washing defects found during denim washing. Then it will restrict the economic increase of all

productions (shown in Figure 2). These defects also affect the international financial cycle like Bangladesh.

Bangladesh is the second-largest producer of denim products after China. At the running time, Bangladesh exporting denim products approximately 200 million pieces every year over the world in the European Union and United States market. This thriving industry is mainly driven by its large-scale manufacturing capacity and lower labor cost. According to the Bangladesh Textile Mill Association (BTMA), Bangladesh produces over 437.877 million yards of fabrics every year.

This paper aimed to identify the washing defects of denim garments and the remedies for these washing defects of denim garments in Bangladesh. The other purpose of this paper is to explain how such errors are related to the waste, production, and production costs of denim clothing. It provides a statistical review of the denim sector in Bangladesh as compared to other countries.

The remaining sections of this study are 2. Description of Denim Garments Washing Defects and Remedial Action in Bangladesh; 3. Graphical Relationship between Denim Garments Washing Defects and Wastage, Production, and Production Cost in Bangladesh; 4. Methodology; 5. International Denim Market; 6. The Role of Denim Sector in Bangladesh's RMG Sectors; 7. Conclusion and Implication.

2. Description of Denim Garments Washing Defects and Remedial Action in Bangladesh

Denim clothing occurs in the form of washing finished denim products^[3]. If any part of the denim garment is not required to wash, we can staple it to these areas.

Like other textile dyeing and finishing processes. As with other textile dyeing and finishing processes, the quality of the final garments plays an important role in buyers' final decision of acceptance or rejection^[5]. There are several washing defects associated with denim washing and remedial action of washing defects as follows:

2.1 Washing Damage

2.1.1 Causes

When denim garments damage as a result of washings, then it is called washing damage of the denim garment. At the time of denim washing, it's very sharp parts in the washing machine may come in contact with denim garments, causing washing damage. Besides, when using stones for washing, the stones may also get abraded along with the denim garment.

Thus, the stone quartz is exposed, and sharp points

develop that can cause erosion in the garments, which can cause surface damage.

The Damages may also occur for the following reasons such as; overtime washing, over tumbling, overpressure on the denim garments, uneven machine running, etc.

2.1.2 Remedial Actions

When using a washing machine, it should take the necessary steps to avoid the contact of the denim garments with sharp points of the washing machine.

When using stones, the visibility and size of the stone should monitor to prevent excessive erosion. It can cause surface damage. Overall to reduce washing damage of the denim garments products, we should take the optimum limit of these above causes which occurs washing damage.

2.2 Loss of Elasticity after Washing

2.2.1 Causes

In denim garments, spandex fiber uses which increases the elasticity of denim garments. Spandex fiber can easily decompose at a higher temperature, and it gets hydrolyzed, which will occur a loss of elasticity of denim garments after washing.

2.2.2 Remedial Actions

During the de-sizing process, it should use an enzyme instead of alkali for de-sizing. The washing temperature should be kept at around 55°C and should not exceed 60°C. If these temperature ranges are crossed then it will produce watermarks. In the case of bleach washing, the amount of sodium hypochlorite should be used as required for bleaching wash.

2.3 Dimensional Change after Washing

2.3.1 Cause

When an improper shrinkage system will remain in denim fabrics before being made into denim goods, dimensional change may occur after washing.

2.3.2 Remedial Actions

If the size of the garment increases after washing, it may be put in the washing machine and washed with water only for gentle washing. This helps achieve a slight shrinkage in the denim garments. However, this gentle washing must not lead to color change. Compressive shrinkage treatment should be conducted on the denim fabric. If the size of denim goods decreases after washing,

it can be steamed inside the washing machine to improve the improper shrinkage problem.

2.4 Yellowing after Washing

2.4.1 Causes

In the case of bleach washing, normally yellowing may occur after bleach washing. Yellowing of denim garments is generally caused by excessive usage of sodium hypochlorite in bleach washing. Yellowing occurs due to the presence of the residual chlorine in sodium hypochlorite. The unremoved impurities or metallic/mineral contents in pumice stones can contribute to yellowing. Yellowing can also be caused by softening agents. Besides, atmospheric contaminants/gases can accelerate the yellowing of washed denim on storage. During denim garments washing, the improper optical brightening process occurs yellowing in denim goods. Besides, if the water used for washing contains a high amount of calcium or magnesium ion, it also creates yellowing in denim goods.

2.4.2 Remedial Action

During bleach wash, neutralization should be carried out thoroughly to remove residual chlorine after using sodium hypochlorite for washing. The operational parameters of the optical brightening process should properly control. The water should be free of hazardous ions, which creates yellowing in denim goods.

2.5 Odor after Washing

2.5.1 Causes

There are many types of washing methods in denim washing. Especially, the odor is found in bleach washing, enzyme washing, and stone washing. There are some causes for odor in denim washing such as improper neutralization, poor water quality, and insufficient rinsing.

2.5.2 Remedial Actions

It should be properly neutralized in denim garments and rinsed after washing and also be checked for water quality before washing.

2.6 Over Washing

2.6.1 Causes

During washing, it is necessary to apply the optimum temperature, washing time, and P^H in the washing machine. Denim garments washing maintains an optimum limit of temperature, washing time, and P^H , when it cross-

es its optimum level, causing over washing.

2.6.2 Remedial Actions

For minimizing over washing, it should be controlled washing parameters such as washing temperature, washing time, and P^H during washing. There are different types of denim washing processes; for each process, there is an optimum range of temperature, washing time, and P^H value. For getting effective results from washing we should apply the optimum ranges of these above washing parameters.

2.7 Washing Spot

2.7.1 Causes

Mainly, washing spots may occur due to excess amounts of chemicals in washing machines. These defects may occur for the washing machine operator. Besides, washing spots occur when any weak parts of the washing machine break and fall in the washing system. There are also many causes of washing spots as follows: it may occur due to over p^H level, overheat, over time washing, etc.

2.7.2 Remedial Actions

It is very important to select the optimum amount (percentage) of the required chemicals before the washing system. Before washing, it should be monitored that the optimum amount of chemicals is used or not in the washing process. If the amount of chemicals is optimum then the operator can start the washing process, otherwise, it will appear as a washing spot in denim garments. The operators should monitor the whole parts of the washing machine and replace the potential parts instead of weak parts of the machine that will help to reduce the washing spot. By controlling above these causes, it may be able to minimize washing spots.

2.8 Care Label Damage

2.8.1 Causes

Care label is an essential part of a garment product. It gives some valuable indications about a garment product. It may also damage due to over temperature, over washing time, over tumbling over friction, over chemical reaction, etc.

2.8.2 Remedial Actions

Care label is essential for a garment product. It should protect them from damages. To protect them, it should be maintained in the washing process very carefully. If any

wrong step is taken in the washing process, then it will be damaged, so it should be controlled the whole washing process properly.

2.9 Poor Hand Sanding

2.9.1 Causes

Every washing process has a certain requirement which gives the perfect result of Washing.

Hand sanding (dry process) does remove the color or fade specific areas of the denim garments and has become very important nowadays^[5]. During this process, some equipment is required such as abrasive paper, air dummy (horizontal), and gum tape.

Improper abrasive paper, non-smooth air dummy, and inappropriate gum tape can cause poor hand sanding.

Besides, if the denim garments are not mounted perfectly on the air dummy and the pressure of the hand is not uniform during sanding these will occur poor hand sanding.

2.9.2 Remedial Actions

Before doing this process, first, collect the proper equipment/tools to do this process. In this case, effective abrasive paper, smooth air dummy, and suitable gum tape are required. The denim garments should be mounted perfectly on the air dummy and the pressure of the hand should be uniform during sanding to minimize poor hand sanding.

2.10 Off Shade

2.10.1 Causes

All buyers require the standard shade or color of denim garments. When the buyer's required shade is not appeared after denim garments washing. Then it is called off shade. If the shade/color is less or more than the buyer's requirements then it terms as off shade. Off shade mainly occurs due to over washing. It may also occur due to excess/less amount of chemicals than required, high/low temperature than required, high/low pressure than required, over/less tumbling, unstable P^H ranges, unskilled operators, etc.

2.10.2 Remedial Actions

To prevent off shade, it is necessary to maintain the buyer's requirement. During washing, it should control over washing that may cause off shade. Besides, it should control properly the number of chemicals, washing temperature, washing pressure, tumbling, and P^H ranges during denim washing to prevent off shade of denim garments. It

is important to remember to choose a skilled operator that will help reduce the shadow of the final content.

2.11 Shade Variation

2.11.1 Causes

Shade variation is mainly dependent on the fabrication and washing process. Improper fabrication and washing processes affect shade variation. During the washing process, chemical variation affects the shade variation of denim garments. When using improper washing time and temperature, causing shade variation, also may occur due to variation in color of each lot of denim fabric.

2.11.2 Remedial Actions

Proper fabrication and washing can minimize shade variation of denim garments. During denim washing, it should be checked the concentration of chemical regularly to ensure that there is no loss of the function of the chemical, for example, the enzyme activity of cellulose and active chlorine content in sodium hypochlorite. Conduct trial washing to minimize the color variation between each lot of denim fabric and find a suitable washing condition. It should be an essential trial run to find the variations of final shades in different lots of denim fabric after washing. It should also be properly controlled washing time, temperature, and color variation for each lot of denim fabric during washing.

2.12 Poor Sandblasting

2.12.1 Causes

Poor sandblasting is like poor hand sanding, sandblasting (dry process) is the process of scrubbing off the denim garment by blowing high-speed air mixed with very fine particles of sand. This process is more health hazardous than hand sanding. Aluminum oxide (Al_2O_3) is used for sandblasting which looks like sand. Poor sandblasting has occurred due to improper selection of aluminum oxide, uneven blowing angle, and improper placement of the denim garment on the bed of a closed chamber and also due to unskilled operators.

2.12.2 Remedial Actions

When using aluminum oxide, it should be very fine and hard/sharp. During sandblasting, the blowing angle is very important to get perfect sandblasting. The flow of aluminum oxide on denim fabric surfaces is done at 10-20° (optimum) angles. Besides, it should check the proper placement of denim garments on the bed of the closed

chamber before sandblasting. It also requires skilled operators for this process (sandblasting).

2.13 High P^H Level

2.13.1 Cause

P^H level is an important factor in denim garments washing. Higher levels of pH reduce the washing properties of denim garments. It may occur due to the unskilled operator of denim washing.

2.13.2 Remedial Actions

For a better view of denim clothing, the denim washing process requires an experienced / skilled operator.

The operators should monitor the optimum p^H level according to buyers' requirements to avoid a high P^H level for minimizing defects of denim garments during washing.

2.14 Poor Grinding

2.14.1 Causes

Denim washing is a process with too much input & tools [4]. In grinding (dry process), there are many tools used for getting old outlook appearance and high fashion denim garments. Grinding is the destruction of edges or the worn-out effect on the edge of the garments. Generally, it is done on the hem, pocket edge, west belt, and pocket opening of the denim garments. For the grinding process, small size stones are used in the grinding machine. Poor grinding occurs due to improper (non-smooth) size of stones, uneven mark the place to be destroyed by the grinding machine, different types of improper grinding machine tools such as grinding wheel, needle, knife, safety accessories, and inexperienced operators.

2.14.2 Remedial Actions

When using stones, it should be necessary to take a very smooth and round shape of small size of stones in a grinding machine. Before doing this process, it should be considered the proper grinding machine tools. Defecting fewer tools of the grinding machine gives an effective grinding result. During this process, it should be required for experienced operators to prevent poor grinding of denim garments.

2.15 High Abrasion Effect

2.15.1 Causes

The results obtained from denim washing represent a

combined effect of color dissolution, destruction of the dye, and mechanical abrasion, which sometimes causes the removal of surface fibers from the materials^[5]. High abrasion effects are generally found in bleach washed, enzyme-stone washed and snow washed denim garments. During the washing process, if the washing time is not properly controlled, it causes a high abrasion effect on denim garments. It also may occur due to uneven tumbling and huge amounts of denim garments in the washing machine.

2.15.2 Remedial Actions

During washing, to prevent high abrasion effects it should be required to control washing time properly. At the time of washing, the color should be checked with the standard regularly/buyer's requirement. Besides, it should be controlled uniform tumbling and optimum amount of denim garments in the washing machine. Overall, before the actual production, a washing trial should be conducted to find the best condition for doing bulk production.

2.16 Color Bleeding at Pocket Bag

2.16.1 Causes

Color bleeding at the pocket of denim garments occurs due to many causes. At the time of washing, when using washing temperature is too high or too low in the case of enzyme washing, leading to deactivation or inactivation of the enzyme, causing color bleeding at the pocket. When hydro extraction is not properly conducted (water content in denim garments remains high) and the stacking time of hydro extracted fabric is too long, causing these defects. When using washing chemicals, if the chemicals are not good or the washing chemicals have lost the primary functioning, causing these defects. Besides, drying too many denim garments at the same time and too high a temperature also occur these defect. Besides, insufficient rinsing and no rotation of washing machine during rinsing may occur these defect.

2.16.2 Remedial Actions

During enzyme wash, it should be properly controlled washing temperature, washing time, and also be checked the quality of the enzyme. It also should apply sufficient rinsing and rotation of the washing machine during rinsing. When using chemicals, it should be checked the quality and primary function of the chemicals. Besides, the hydro extraction and drying process should carefully control.

2.17 Poor Hand Feel

2.17.1 Causes

During denim washing, improper washing time may cause insufficient abrasion between denim garments, which causes poor hand feel. Many washing methods give different hand feels, such as de-sized fabrics for stone washing have a softer hand feel than non-de-sized fabrics for stone washing. Overall, if the different types of the washing process are not properly controlled, poor hand feel will appear. In washing, there are many types of softening agents used for the washing process, for example, nonionic type and cationic type. The use of unstable amounts of softening agents in washing occurs poor hand feel. Besides, uneven softening treatment time and liquor to denim goods create poor hand feel. Besides, improper drying time and too many denim garments in the washing machine also creates a poor hand feel.

2.17.2 Remedial Actions

It can minimize the poor hand feel of denim garments by taking some steps. By controlling proper washing methods and washing time. To minimize poor hand feels it should be applied with a proper amount of softening agents, uniform softening treatment time, and liquor to denim goods. It also should control proper drying time and the optimum amount of denim garments in the washing machine to prevent poor hand feel.

2.18 Washing Mark

2.18.1 Causes

Washing marks occur by different kinds of washing machines at different washing stages. During denim washing, if a long spot appears in denim garments then it is called a washing mark. During stone washing, washing marks generally are found in stone bleaching and stone abrasion processes. Washing marks may occur due to the high abrasion of stone in washing machines and also for the uneven size of stones. During denim washing, the stiff (synthetic fibers) fabric abrades with the washing machine which creates the washing mark. During production and transportation of denim fabric, automatically produce creases in denim fabric. If these creases are not removed from denim fabric before washing these will appear as a washing mark during denim washing. The loose and long threads in the denim garments are not removed properly. Then during the washing process, the loose and long threads cause entanglement of the denim garments, leading to washing marks. When using water, the amount of

water used for washing is too much or too little, causing washing mark. Insufficient hydro extraction, improper drying time, and drying temperature also occur washing marks during denim washing.

2.18.2 Remedial Actions

In the case of stone washing, it should be very carefully monitored to prevent high abrasion of stone, also requiring very smooth round shape stones for stone washing. Before washing, fabric composition should be checked properly for synthetic fibers. Besides, existing crease marks should be found out. If possible, before washing, the denim garments should be completely wetted and placed evenly in the washing machine for washing. All loose and long threads must be removed before washing. The maximum length of loose threads should be less than 2cm to prevent fabric entanglement during washing. The amount of water used for washing should be checked during washing. The washing machine may stop regularly to see whether there is entanglement during washing. The denim garments should be properly hydro-extracted and placed evenly in the dryer for drying. Drying time and temperature should be carefully controlled.

3. Graphical Relationship between Denim Garments Washing Defects and Wastage, Production, and Production Cost in Bangladesh

3.1 Graphical Relationship between Denim Garments Washing Defects and Wastage

Denim washing defects are related to different types of terms, for all terms, it (defects) gives unwanted things. Washing defects affect the whole production process which is interrelated to each other. For this, washing defects are closely related to wastage. Many wastages will appear if the washing defects occur during washing. If a denim washing defect occurs and then the primary material (raw materials), denim fabric, electricity, chemicals, manpower, equipment, energy, money, and time are revealed as a wastage. Thus, it can be said that "Wastage is directly proportional to the washing defect". If the washing defect increases then the wastage will also increase. Similarly, if the washing defect decreases then the wastage will also decrease. This means that if the washing defect increases, the amount of wastage will also increase. On the other hand, the amount of wastage will be reduced, if the washing defect is reduced. Figure 3 shows the graphical relationship between denim garments washing defect and wastage:

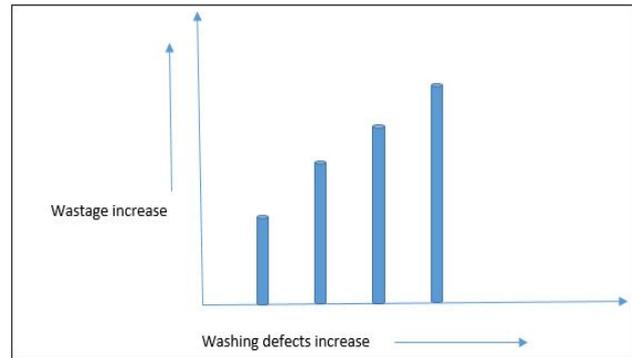


Figure 3. Washing Defects Versus Wastage

3.2 Graphical Relationship between Denim Garments Washing Defects and Production

Production of the final products of denim depends on the washing process. If the washing process is good then it will give the expected production of final products. If the washing process is not good then the expected production will not be available. Thus, it is found that production is well related to the washing process. For this, it can be said that "Production is inversely proportional to the washing defect". This means that if the washing defect increases, the amount of production will decrease. On the other hand, the amount of production will increase, if the washing error decreases.

Thus, some necessary steps should be taken to get the product as per the expectations of Denim Garments. It is possible by reducing washing errors. Figure 4 shows the graphical relationship between denim garments washing defect and production:

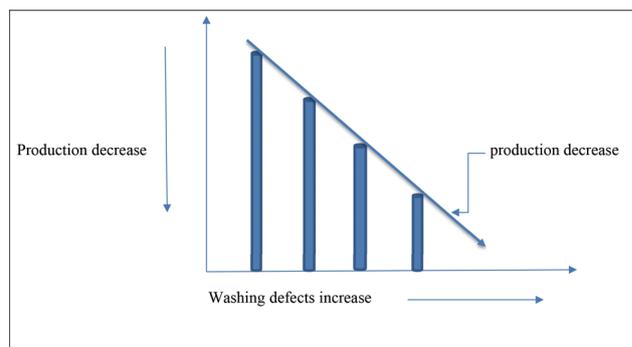


Figure 4. Washing Defects Versus Production

3.3 Graphical Relationship between Denim Garments Washing Defects and Production Cost

Every organization (industry) has a goal or destination for surviving in this competitive world. There is no organization without a goal. Similarly, all of the industries have their own goal or plan. There are many goals in

every industry, among which production is an important issue. Production is an important step that plays an important role in the delivery of the final product. Production cost is well related to the washing process. If a washing defect occurs during washing, it will have a great impact on the production cost. Thus, it can be said that "Production cost is directly proportional to washing defect". This means that if the washing defect increases, the amount of production cost will increase. On the other hand, the amount of production cost will be decreased if the washing defect is reduced. Figure 5 shows the graphical relationship between denim garments washing defect and production cost:

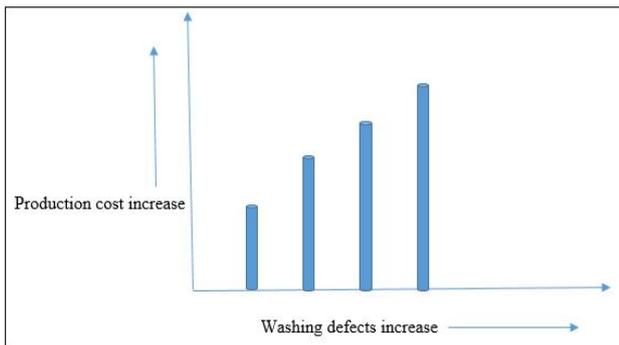


Figure 5. Washing Defects Versus Production Cost

4. Methodology

This paper is conveyed based on theoretical, analytical, and statistical. It appears washing defects of denim garments and also reveals the effect of washing defects on wastage, production, and production cost of denim garments. It shows the statistical (data) review with the help of the WTO (World Trade Organization), Eurostat, OTEXA, BGMEA, and Bangladesh bank for analyzing the denim sectors in Bangladesh compared with other countries.

5. International Denim Market

5.1 United States (US) Denim Apparel Market

Denim, a fundamental component of the casual wardrobe, has become a staple textile within the global apparel market. The market value for denim fabric was 90 billion U.S. dollars in 2019. And it was expected to increase to 105 billion U.S. dollars by 2023. In the last few years, Bangladesh and China are the two Southeast Asian countries that have been leading the US denim exports charts along with Mexico. The USA is one of the top consumers of denim jeans with an estimated demand of 450 million pieces per year, followed by the European Union (EU).

The US's top three suppliers of denim jeans include China, Mexico, and Bangladesh. Top denim garments exporting countries include China (26.5%), Mexico (24.4%), Bangladesh (13.1%), Vietnam (4.7%), Egypt (3.5%), Pakistan (5.3%), Nicaragua (3.1%), Cambodia (3.1%), Indonesia (2.5%) and others country (13.8%) (Source: The World Trade Statistical Review and EBLSL Research).

5.2 Bangladesh

Bangladesh is recognized as one of the most significant centers for denim apparel production around the globe. It ranks as the second-largest denim garments exporter after China. Bangladesh currently imports almost half of its fabric requirements from India, Pakistan, and China. On the front of the garment, industry players are increasing capacity to maintain current market share in global trade and to boost total denim exports to \$7b by 2021. Bangladesh is the largest exporter of denim products to the EU, with 27% of the market share third-largest to the US market with a 13.1% market share. According to the US Office of Textiles and Apparel (OTEXA), Bangladesh's denim exports to the US market to \$606.33 million in 2019, which was \$566.39 million in the previous year (OTEXA). According to Eurostat, Bangladesh in 2019 exported denim products worth \$1.78 billion from \$1.65 billion in 2018 (Eurostat).

5.3 India

In India, the denim sector is growing at a consistent CAGR of 13% to 15% per year led by escalating local demand. India's share in the global denim jeans trade accounts for 2.5% with a 10% share in global denim manufacturing capacities. The Indian denim industry is primarily aiming to increase its share in exports, which currently stands at around one-third of total production. The total denim fabric capacity of the country stands at 1.2b meters/annum reporting utilization levels of 75%, of which only 28% is exported.

5.4 China

Chinese denim exports are following a declining trend owing to the increase in labor cost in XintangHub of Textile Manufacturers in China. However, demand growth is expected to remain healthy due to the sizable millennial generation who reside in middle-class cities. China is the largest exporter of denim goods to the US denim markets. China exports denim goods to the USA to \$951 million in 2019, which was \$937 million in the previous year (OTEXA).

5.5 Mexico

Bangladesh and China are the two Southeast Asian countries that have been leading the US denim exports charts along with Mexico. Mexico is one of the highest countries in the US denim market. On top of that, Bangladesh has established its strong footage in the US market after China. And Mexico with a gradual rise in market share and occupied 14.68% in 2018. Mexico has seen an 8.80% increase in export, from \$793.22 million to \$863 million from the same period of the last year.

5.6 Cambodia and Pakistan

Cambodia has seen a 20.50% rise in denim export to \$112.86 million followed by Pakistan's 15.26% growth to \$246.40 million (OTEXA).

5.7 Top Exporter Countries of Clothing, 2019

There is no any country all over the world, which country is fulfilling without other countries. Every country is dependent on each other directly or indirectly all over the world. Every country needs different types of help from other countries for many purposes. All countries share their materials with other countries for a balanced situation. All over the world, every country exports and imports their needs from other countries. The current dollar value of world textiles (SITC 65) and apparel (SITC 84) exports totaled \$315 billion and \$505 billion in 2018 respectively, increased by 6.4% and 11.1% from a year earlier. This has been the fastest growth of the world textile and apparel trade since 2012. China, European Union (EU28), and India remained the world's top three exporters of textiles in 2018. Altogether, these top three accounted for 66.9% of world textile exports in 2018, a new record high since 2011. Notably, China and the EU (28) also enjoyed a faster-than-world-average export growth in 2018, up 7.9% and 6.9% respectively (World Trade Statistical Review 2019 by the World Trade Organization). The United States remained the world's fourth top textile exporter in 2018, accounting for 4.4% of the shares, down slightly from 4.6% in 2017. China, the European Union (EU28), Bangladesh, and Vietnam unshakably remained the world's top four largest exporters in 2018. Altogether, these top four accounted for as much as 72.3% of world market shares in 2018, which, however, was lower than 75.8% in 2017 and 74.3% in 2016 primarily due to China's declining market shares. Considerably, even though apparel exports from Vietnam (up 13.4%) and Bangladesh (up 11.1%) enjoyed fast growth in absolute terms in 2018. Their gains in market shares were quite limited (up 0.3 percentage point from 5.9% to 6.2% for Vietnam and up

0.1 percentage point from 6.4% to 6.5% for Bangladesh) (World Trade Statistical Review 2019 by World Trade Organization).

6. The Role of Denim Sector in Bangladesh's RMG Sectors

Mainly the development of our country depends on export products. At the running time, Bangladesh is exporting, RMG, medicine, software, manpower, etc. where the RMG sector is dominating and running the productivity to achieve SDG by 2021. In Bangladesh, the textile sector comprises two divisions mainly Primary Textile Sector (PTS) and export-oriented Ready-Made Garments (RMG). Over the last 35 years of fight and dedication, Bangladesh is now experiencing a higher growth rate. In the RMG sector,

Denim garments are one of the most necessary parts of the textile sector in Bangladesh. In the global market all over the world, Bangladesh is now more prominent as a supplier of denim products. Bangladesh is the second-largest producer of denim products after China. This is because of the manufacturer's continuous machinery up-gradation. Nowadays people in denim clothing are using advanced technology to make denim jeans and other denim products.

Bangladesh is exporting denim products approximately 200 million pieces every year all over the world. By exporting denim products all over the world, these sectors allow gaining financial support in the RMG sector from other countries. As a result of this fact, it can be easily said that the denim sector plays an important role in achieving the second position in RMG sectors all over the world. The following Table 1 shows the share of ready-made garments (RMG) in national export. This table shows that most of every year the share of RMG sectors in national export has increased as compared with other sectors in Bangladesh. Bangladesh gross domestic product (GDP) increased from \$6.29 billion to \$286 billion from 1972 - 2019, where \$41 billion was generated by exporting, and surprisingly around 84% comes from exporting textile and garment goods (World Bank-2019) and also where denim garments remained a big part of RMG sectors in Bangladesh. As per the WTO publication, Bangladesh remained the second-largest exporter of clothing after China, while Vietnam (6.2%), India (3.5%), and Turkey (3.2%) ranked third, fourth and fifth respectively (World Trade Statistical Review 2020 in Geneva). As a result, Bangladesh holds the second position in the RMG sectors where the denim garments sector plays an important role to achieve this position.

Bangladesh share of ready-made garments (RMG) in national export as follows:

Table 1. the share of ready-made garments in national export of Bangladesh

Year	Total Export of Bangladesh (in million US\$)	Export of RMG (in million US\$)	Share of RMG (%)
2010-11	22924.38	17914.46	78.15
2011-12	24287.66	19089.69	78.60
2012-13	27027.36	21515.73	79.61
2013-14	30186.62	24491.88	81.13
2014-15	31208.94	25491.40	81.68
2015-16	34257.18	28094.17	82.01
2016-17	34655.92	28149.84	81.23
2017-18	30614.76	36668.17	83.49
2018-19	34133.27	40535.04	84.21

Source: BGMEA, Export Promotion Bureau, Bangladesh Bank (2019).

6.1 Bangladesh Holds the Second Position in RMG Sectors

According to the latest statistics from the World Trade Organization (WTO), Bangladesh's global clothing export market share has increased to 6.80 percent in the last year which was 6.40 percent in 2018. At the same time, Vietnam's clothing export share has remained unchanged at 6.20 percent, however, the country has registered an annual growth of 8.0 percent in exports, compared to about 2.0 percent growth in garment exports from Bangladesh (World Trade Statistical Review 2020 in Geneva). China remained the top clothing exporter in the world with a 30.80 percent share, although it declined from 31.30 percent in 2018. As per the WTO publication, Bangladesh remained the second-largest exporter of clothing after China, while Vietnam (6.2%), India (3.5%), and Turkey (3.2%) ranked third, fourth and fifth respectively (World Trade Statistical Review 2020 in Geneva). There was an opportunity for Bangladeshi apparel makers as the US-China trade war forced global buyers to relocate the business and diversify sourcing destinations. Bangladesh's apparel market share in the global market is close to 7% and it continues to grow. It is a positive sign for the export-led economy. And reducing the gap with China, the largest exporters of clothing goods. The most promising sector in Bangladesh is the ready-made garments industry. It earns 29.65%, 28.54%, and 27.75% (Nov 18, 2020-world statistic 2020) of total GDP in Bangladesh in the year 2019, 2018 and 2017 respectively.

7. Conclusions and Implication

In this paper, we have shown the denim washing defects of Bangladesh and at the same time described the preventive measures of the defects. We have also shown the graphical relationship between denim garments washing defect and wastage, production, and production cost. Industrial washing is a very important applied finishing method for denim products. Different types of washing methods can be applied for denim fabrics to achieve a special outlook of denim products. Washing is the process that has been causing some losses and the appropriate identification of washing defects in the process is accurately mentionable for taking helpful actions before other steps in denim production. For this reason, the washing defects of denim garments in the washing process, and denim products sent for repair or removed from the production stage, before the final control of the product that is about to be finished and separated as waste. So, if any washing defect on the denim finished product is not noticed and then the dyeing stage is passed and the finished product reaches the consumer or customer in this state, various problems arise, and the trust of the consumer or customer is shaken. At the running time, consumers/customers (mainly the youth generation) are interested to wear denim garments for the easement. Denim is considered a comfortable dress^[1]. For getting this good feeling to wear denim, it is necessary to minimize the maximum amount of washing defects of denim garments in Bangladesh. Bangladesh is exporting denim products approximately 200 million pieces every year all over the world. Bangladesh is recognized as one of the most significant centers for denim apparel production in the world. It ranks as the second-largest denim garments exporter after China (According to WTO). Based on the results of this paper, this study gives a policy implication about this field which are as follows: 1. When washing denim, we have to take very good care that the washing defects do not happen. And even if there are washing defects, the maximum goal of denim production can be reached by eliminating denim washing defects by applying remedial actions. 2. Removing denim washing defects, will reduce wastage, and reducing wastage will increase production. As the wastage decreases, so reduce the production cost, so the denim industry will be able to make a lot of profit. 3. The statistical review shows that the denim sector of Bangladesh plays a very important role in the denim market all over the world. Especially after the denim sector of China, Bangladesh's position. Seeing such a huge achievement in the denim sector of Bangladesh, other countries can also become competitive.

Therefore, Bangladesh will be more interested to take the denim sector to the first position. The washing defects of Denim Garments in Bangladesh revealed the implication of this paper. By reviewing this paper the manufacturer of denim garments in Bangladesh and other countries will be able to minimize the maximum amount of washing defects of denim garments, as a result, they (manufacturers all over the world) will be able to improve their economy by exporting their denim products all over the world. Finally, it will help to improve the economy and people living standards of Bangladesh.

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