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**ARTICLE**

# Re-designing Conventional Face Mask by Using Triz (Teoriya Resheniya Izobreatatelskikh Zadatch) Method

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**ABSTRACT**

New Normal becomes the way out to keep Indonesia's weakened economy because of covid-19 pandemic stays in balance. Of course, New Normal must be well-balanced with the application of strict protocols to reduce transmission rates and anticipate a surge in new cases. From a few points of pandemic protocols, using face mask is considered as the most-effective basic need. Re-designing the mask is aiming at eliminating the worsening feature and developing the improving feature. This research is developing the widely used 1-ply mask, which doesn't meet WHO standard regarding cloth-material mask that must be made in 3-ply. The method used in this research is TRIZ (Teoriya Resheniya Izobreatatelskikh Zadatch), an inventive problem solving theory to the issues regarding ideas, products, or concepts, in this case is face mask redesigning concept. In this research, the data are collected by doing library research to obtain secondary data that will be processed in qualitative and quantitative methods. The results show the aspects that should be eliminated from cloth-material face mask are brittle for being easily damaged, short period of usage, and non-reusable. After the redesigning concept is carried out using the principles and features of TRIZ method, some aspects such as weight, material, design, and functionality are developed. The result is a relatively light weight face mask because the using of PLA+ filament-based material with good durability and environmentally friendly. This design has a longer period of usage, and the user only needs to replace the additional inserted tissue every 4 hours. The researchers hope that the new design can be further developed by government to deal with New Normal and other possibilities in the future.

## 1. Introduction

Covid-19 (Novel Coronavirus disease 2019) is a virus that causes mild to severe infections of respiratory tract such as common cold, runny nose, fever, cough, and short

breath. These symptoms will be severe if the patient is old and has comorbidities, such as obstructive pulmonary disease, heart disease, so-on. The transmission happened from animals to humans (Zoonosis) and from humans to humans. The spreading cannot be underestimated. For

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human to human transmission, it occurs when respiratory droplets from people with Covid-19 reach mucous areas of respiratory tract such as nose and mouth, as well as the eyes. We need to know that the infectious droplets are fluids dispersed from human respiratory tract when talking, coughing, or sneezing. This is a very important thing to comprehend, so that we can anticipate all the possibilities of Covid-19 infections, especially considering the rapid spread.

Early December 2019 became a scourge for the world, as the beginning of the spread of covid-19 occurred in Wuhan, China. The spread was suspected to be occurred because of an unhealthy lifestyle of Wuhan people, by eating unusual animals such as centipede, caterpillar, scorpion, bat, so-on. January 1, 2020, the Huanan Seafood Wholesale Market in Wuhan was closed as being suspected to be the starting point for the spread of Covid-19.

On March 2, 2020, the Indonesian government announced the first 2 positive cases of Covid-19 patients. However, the identification of those cases had found that the case no longer imported but local transmission. The entry of the virus occurred through international gateways in several parts of Indonesia. In January, this new type of corona virus was announced to be transmissible between humans, and had spread to various countries outside China through travel between countries.

3D mask is a type of face mask developed by FTI UMI to deal with Covid-19 pandemic. Before, cloth-material face mask had to be replaced with a new one every 4 hours of usage for a safe using. Above all, market price of masks had been sky-rocketed due to irresponsible practices of hoarding and selling medical masks at unreasonable high prices. Based on the phenomena, the researchers developed a new concept of the face mask to make a longer usage, cheap, efficient, and environmentally friendly, which called as 3D Face Mask.

3D face mask is made from filament materials. Filament is a recycling material made of used plastic and corn extract, while the printing process using 3D printer as the main tool. 3D printer melts the filament, shapes the design, and prints the material into mask. Besides being environmentally friendly and efficient, to use this mask is also convenient. Based on the recommendation to use a mask for 4 hours maximum, by using 3D mask, users can only change the tissue as the main filter, so the inconvenience for changing the mask to a new one in every 4 hours is lessened.

Products are everything offered to the market to fulfill wishes or needs. The term of product is including tangible goods, services, events, places, organizations, ideas or combinations of mentioned things. Siswanto Sutojo (2005:

78) states that companies must pay attention to several important factors in formulating their product strategy<sup>[1]</sup>. The first factor is the strategy in selecting market segments that has been decided. The second factor is understanding the essence of product in buyer's point of view. The third factor is product strategy at the extent of product series, individual product combination, and product combination as a whole. Furthermore, the fourth factor is the focus of marketing strategy at each stage of product life cycle<sup>[1]</sup>.

A product is considered as good if it has the quality which fits to customer wishes, with as minimum defects as possible. Quality control has the functions to suppress the number defective products, to maintain products quality that meet company standards, and to prevent continuous distribution of defective products to consumers<sup>[2]</sup>.

According to Montgomery (2001), Quality Control is a "Purposeful activity. With technical Quality Control activities or management, product characteristics can be measured, compared with product specifications or requirements, then performed appropriate improvement measure for any difference between the actual appearance, according to standard"<sup>[2]</sup>.

TRIZ (Theory of Inventive Problem Solving) is generated from Russian acronym "Teoriya Resheniya Izobreatatelskikh Zadatch", a method developed by Genrich Altshuller. TRIZ has stages or algorithms for problem solving, started from determining the specific problem by identifying the contradiction that occurs. The identified contradictions that have been resolved will be applied into general solutions to create specific solutions (Navas, 2014). The stages in this research used several theories related to TRIZ method, consisted of the innovation situation questionnaire, diagram of situation model, direction for innovation, and inventive principles.<sup>[3]</sup>

According to Putri and Oemar (2017), problem solving process with TRIZ method has three stages, as follows:

(1)Identifying the problem by finding out all possible factors that could become a problem.

(2)Classifying the problem by determining the supporting and opposing factors into 39 technical parameters, and using the contradiction matrix to find the solution as its further settlement pattern.

(3)Finding problem solutions that have to be done in resolving the contradictions by using 40 creative principles

Quality Function Deployment (QFD) is a methodology in design and development process of a product or service which able to integrate the "consumer's voice" into design

process. QFD is actually a way for companies to identify and fulfill consumer needs and desires for the products or services they produce<sup>[4]</sup>.

Yuliarty, et al. (2013) states that QFD brings a number of benefits to organizations that seek to continually increase their competition in improving their quality and productivity. The benefits of QFD include:

(1) Focus on the customers. QFD requires to muster up input and feedback from customers. The information is then translated into a set of customer's specific requirements.

(2) Time Efficiency. QFD can reduce the time needed in product development because it focuses on specific, clear identification of customer requirements.

(3) Teamwork orientation. QFD is a teamwork orientation approach. All decisions in the process are based on consensus and obtained through in-depth discussion and brainstorming.

(4) Orientation to documentation. One of the products generated from QFD process is comprehensive document of all data related to the whole processes, and its comparison with customer requirements.

Another benefit that can be obtained from implementing QFD is customer focused<sup>[5]</sup> including getting input and feedback from customers related to their needs and expectations. This is important, because the performance of an organization cannot be separated from customers, especially if the competitors are doing the same thing.

QFD process is started from market segmentation research to find out the prospective customer for the product, customer characteristics and needs, and then evaluates the market competition level. The results of market research are technically translated into a product design that fits customer requirements. It is then continued with *process design* which is designing product manufacturing process to find out the characteristics of each part or stage of production process. Then, the operation or production process and the flow of production process are determined. Lastly, production plan and implementation which resulted in products according to customer needs is arranged<sup>[6]</sup>.

## 2. Research Method

The steps in this study consisted of several stages. The first step was the identification of the problems that occur. The problem in this case was how to redesign conventional mask into an excellent item in terms of quality and comfort by using TRIZ method, with the help of Quality Function Deployment (QFD) tools.

The second step was to conduct literature study over several journals and previous research related to product

design and development. The next step was to collect and process the data. First, QFD was used to determine the attributes of consumer needs and desires and then translate them into product specifications. The initial stage was extract the information regarding consumer needs by distributing satisfaction questionnaires to 120 populations (100 respondents) and interests with 14 attributes and 1-5 of Likert scale. Operational definition of this research was:

**Table 1.** Operational Definition of Research Variables

| No | Variables                                | Operational definition                                                                        | Categories                                                                                                                                                               | Measuring instrument | Scale   |
|----|------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------|
| 1  | The level of consumer needs              | Research materials taken directly by consumers for the development of a product               | <ul style="list-style-type: none"> <li>• Urgently Needed</li> <li>• Needed</li> <li>• Quite needed</li> <li>• No need</li> <li>• Highly no need</li> </ul>               | Questionnaire        | Ordinal |
| 2  | Innovation Situation Questionnaire (ISQ) | Reference based on the concept of a product from sources who are experts in their fields      | <ul style="list-style-type: none"> <li>• Positive &gt;50%</li> <li>• Negative &lt;50%</li> </ul>                                                                         | Questionnaire        | Nominal |
| 3  | The level of customer satisfaction       | To measure the level of consumer satisfaction with the product concept that has been realized | <ul style="list-style-type: none"> <li>• Very Satisfied</li> <li>• Satisfied</li> <li>• Quite satisfied</li> <li>• Not satisfied</li> <li>• Very dissatisfied</li> </ul> | Questionnaire        | Ordinal |

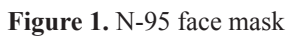
After the questionnaires being recapitulated, HOQ compilation which consisted of several processes was carried out. The process determined the attributes, technical response, interaction matrix, and specifications and targets. The second step used TRIZ method which aimed to resolve contradictory problems in the design. From HOQ, technical response was obtained based on the highest priority attribute. The next step was to reduce all technical and physical contradictions of technical response through TRIZ method, to improve the performance of existing design. Started with the determination of specific problem obtained from the technical response result to the results of the questionnaire, then proceed with determining the general problem of technical and physical contradictions. The technical contradiction had resolved immediately with contradiction matrix table and *40 inventive principles* tools, while physical contradictions used either *separation principles* tool or *40 inventive principles* tool. The last stage in TRIZ was to find the best solution from the alternative solutions given.

After obtained the chosen alternative, the next step was the process of product design for 3D Ergonomic Masks

Technical response was determined after planning matrix had obtained. Technical response is a reference or technical specification which will be carried out to fulfill each attribute. In other words, technical response is a solution provided by producers to meet what consumers want. This specification consists of metrics and metric values.

### Table 3. Technical Response

| Atribut                                                                                           | Metrik                |
|---------------------------------------------------------------------------------------------------|-----------------------|
| Kemudahan dalam penggunaan                                                                        | Bentuk                |
|                                                                                                   | Material              |
|                                                                                                   | Bentuk clip penyangga |
| Dimensi masker menutupi seluruh bagian mulut dan hidung                                           | Bentuk                |
|                                                                                                   | Bentuk clip penyangga |
|                                                                                                   | Material              |
| Ketersediaan fitur <i>plug in</i> mask untuk mengganti <i>tissue filter</i> setiap beberapa waktu | Ukuran                |
|                                                                                                   | Bentuk clip penyangga |
|                                                                                                   | Material              |
| Ketersediaan tali penyangga yang terbuat dari karet elastis                                       | Ukuran                |
|                                                                                                   | Ketebalan             |
| Ketersediaan ruang sirkulasi udara pada ujung masker di bagian mulut dan hidung                   | Bentuk                |
|                                                                                                   | Ukuran                |
| Kelengkapan bahan utama masker                                                                    | Bentuk                |
|                                                                                                   | Ukuran                |
| Kelengkapan <i>clip</i> dalam masker                                                              | Material              |
|                                                                                                   | Bentuk                |
| Kelengkapan tali penyangga pada masker                                                            | Ukuran                |
|                                                                                                   | Material              |
| Kesesuaian masker dengan konfigurasi wajah pemakai                                                | Bentuk                |
|                                                                                                   | Ukuran                |
|                                                                                                   | Kepapasan Filter      |
|                                                                                                   | Bentuk                |
|                                                                                                   | Bentuk                |
| Kestabilan masker saat digunakan untuk menyaring udara                                            | Ukuran badan masker   |
|                                                                                                   |                       |
| Sirkulasi udara dan hambatan mulut pada masker stabil karena mempunyai rongga                     |                       |
|                                                                                                   |                       |
| Service Produk                                                                                    | Jenis layanan         |
|                                                                                                   | Bentuk masker         |
| Variasi bentuk dan desain masker                                                                  | Bentuk                |
|                                                                                                   | Warna                 |
|                                                                                                   | Ukuran                |
|                                                                                                   | Material              |
| Harga masker                                                                                      | Biaya produksi        |
|                                                                                                   | Material              |
|                                                                                                   | Bentuk                |
|                                                                                                   | Desain                |
|                                                                                                   | Warna                 |
|                                                                                                   | Variasi               |



Based on recapitulation results of *user needs* attributes shown in Table 2 and Table 3, most respondents expected face masks as protective equipment which designed to provide satisfaction and improve masks performance during the usage. Furthermore, 5 functional attributes were generated from some of summarized *user needs* attributes, which able to represent all of *user wants* attributes. Those 5 functional attributes are shown in Table 4 below.

**Table 4.** Functional Attributes of User Need

| Num | Attributes  |
|-----|-------------|
| 1   | Easy to use |
| 2   | Safe to use |
| 3   | Comfortable |
| 4   | Flexible    |
| 5   | Enticing    |

Here were several types of problem models: Physical Contradiction, Engineering Contradiction, and Substance

Field Model. The next step was to determine the Inventive Principles as reference in designing the new model of face mask based on the results of the selected *improving feature* and *worsening feature* attributes.

### 3.2.1 Improving Feature and Worsening Feature.

To solve the designing problems, TRIZ used  $39 \times 39$  table of contradiction matrix attributes, consisted of improving feature and worsening feature. In the first stage of design problem solving, improving feature was determined based on the identified need attributes.

Table 5 and 6 show the improving feature and worsening feature based on the need attributes.

**Table 5.** Improving Feature

| Num | Attributes  | Improving Feature               |
|-----|-------------|---------------------------------|
| 1   | Easy to use | <i>Ease of Use</i> (10)         |
| 2   | Safe to use | <i>Reliability</i> (04)         |
| 3   | Comfortable | <i>Shape</i> (21)               |
| 4   | Flexible    | <i>Ease of Manufacture</i> (09) |
| 5   | Enticing    | <i>Shape</i> (21)               |

**Table 6.** Worsening Feature

| No | Attributes  | Improving Feature                  |
|----|-------------|------------------------------------|
| 1  | Easy to use | <i>Strength</i> (28)               |
| 2  | Safe to use | <i>Ease of Manufacture</i> (09)    |
| 3  | Comfortable | <i>Weight of fixed object</i> (33) |
| 4  | Flexible    | <i>Strength</i> (28)               |
| 5  | Enticing    | <i>Ease of Manufacture</i> (09)    |

*Improving features* and *worsening features* that had been identified and shown in Table 5 and Table 6 indicate that there are various contradictions between the improvement parameters for problem solving among all five problem attributes. One of them is *ease of use* (10) and *strength* (28) for *easy to use* attributes. Then, the desired improvement for *easy to use* attributes is *ease of use* (10) in the main part, but *strength* (28) becomes consideration parameter in convenience improvement to use the main tool. Likewise, for other attributes such as *safe to use* or *enticing* must be solved based on selected TRIZ contradiction matrix. From the results of contradiction obtained, the problem solving was decided through *inventive principles* according to the rules of TRIZ method, so that problem solving could be resolved.

**Table 7.** Inventive Principles

| No | Atribut          | Improving feature               | Worsening Feature                      | Inventive Principles |
|----|------------------|---------------------------------|----------------------------------------|----------------------|
| 1  | Mudah digunakan  | <i>Easy of use</i> (10)         | <i>Strength</i> (28)                   | 04, 09, 12, 17       |
| 2  | Aman digunakan   | <i>Reliability</i> (04)         | <i>Productivity</i> (01)               | 01, 03, 14, 30       |
| 3  | Nyaman digunakan | <i>Shape</i> (21)               | <i>Weight of the fixed object</i> (33) | 02, 07, 10, 12       |
| 4  | Fleksibel        | <i>Easy of Manufacture</i> (09) | <i>Strength</i> (28)                   | 02, 03, 09, 12       |
| 5  | Menarik          | <i>Shape</i> (21)               | <i>Ease of Manufacture</i> (09)        | 03, 04, 09, 19       |

Based on Table 7, several references in resolving contradictions of problem attributes were obtained. *Ease of use* (10) and *strength* (28) on *easy to use* attribute were solved by the approaches of *replacement of mechanical matter* (04), *change in color* (09), *local property* (12), and *use of composite materials* (17). The problem with *easy to use* attribute was the ease of wearing masks for people, especially to prevent the spread of viruses and bacteria, and on one side, by not reducing the quality. Based on the parameters in selected inventive principles, the contradiction could be resolved by *replacement of mechanical matter* (04). Thus, the solution for the qualification is replacing the existing mechanical material on face mask with other mechanical material which more convenient to use. *Shape* (21) and *weight of the fixed object* (33) on the convenient attribute produces *preliminary action* (02) *dynamization* (07), *copying* (10), and *local property* (12). Based on the inventive principles offered, *local property* (12) was chosen. In detail, the solutions consist of changing or replacing the basic material structure of existing masks with other material structures with no negative impact for user's health, so that the mask will provide comforts for user when wearing them. *Ease of manufacture* (09) and *strength* (28) on the *flexible* attribute produced several inventive principles which consisted of *preliminary action* (02), *segmentation* (03), *change in color* (09), and *local property* (12).

From the inventive principles offered, *segmentation* (03) was selected. In detail, the solutions consist of dividing an object or system into separate parts and make an object or system to be easy to dismantle. Furthermore, the *attractive* attributes *shape* (21) and *ease of manufacture* (09) produced inventive principles consisted of *segmentation* (03), *replacement of mechanical matter* (04), *change in color* (09), and *transition into another dimension* (19). Based on the inventive principles offered, the chosen one was *changed in color* (09). In detail, the solutions consist of changing or adding color variants to the mask which fitting the environment so that it gives a cheerful vibes instead of frightening effect on user.

### 3.3 Realization of Design and Work Process

After carried out the quantitative analysis stage to get

the appropriate redesign results, the next step was made a prototype of the new design by using 3D Printer as shown in the image below:



**Figure 2.** 3D Printer

The initial stage was to create a design in the Sketchup application which then converted into a file that can be printed. 3D printer read the design and generated a product prototype for a particular amount of time, by using a specified material called filament. Filament is shown in Figure 3.



**Figure 3.** Filament

Filament used was a PLA + type consisted of organic material from corn extract, which then processed with thermoplastic method to form a filament as shown in Figure 4. After the printing process complete, it resulted as mask body as follow:



**Figure 4.** Mask Prototype

After the prototype finished, the next step was to conduct a direct test to people. The main point of the test was to find out whether the design was in accordance with the real conditions of user or not.



**Figure 5.** User Prototype

This mask was made of a material which strong enough for various conditions and had a longer period of usage compared to other masks. Additional value for the strong material was a clip inside the mask that functioned as a clamp for the filter tissue on the mask to keep the tissue intact, which considered as able to extend its usage period and made it more *flexible* because it allowed user to simply replace the tissue instead of buying a new mask.

After successfully made the prototype, the campus, especially the Faculty of Industrial Technology had begun to mass producing the masks to be distributed to paramedics and planned to distribute them to the public as an important item for Covid-19 prevention. Currently, 3D masks have been used by the campus volunteer team as their main equipment in conducting volunteer activities. It is hoped that this research will have a good impact on New Normal and that the government will be responsive to this research.

#### 4. Conclusions

From the conducted research, which is product redesigning by using TRIZ method, 14 attributes of needs are obtained for processing the design data. Of the 14 needs attributes, there are 5 functional attributes that can represent all of the attributes of users' desires. Those 5 attributes of function are: 1. *Easy to use*. 2. *Safe to use*. 3. *Provide comfort* 4. *Flexible* 5. *Give an enticing impression*.

Based on the functional attributes, the problems are resolved using the *Improving Feature* and *Worsening Feature* of TRIZ method. The results are: 1) material changes to prevent damage by using strong materials, 2) change the material structure into environmentally friendly materials, 3) make cheerful designs and colors to avoid awkwardness, and 4) relatively light weight. 3D masks currently have been produced and developed by Muslim University of Indonesia, especially in Faculty of Industrial Technology and have been used by Relawan Bantuan

Kemanusiaan (Humanitarian Aid Volunteers) and paramedics. The new design of 3D face mask has got positive reviews because of its better quality compared to other conventional masks.

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## ARTICLE

# Evaluating Bullying Effect on the Happiness and Performance of the Ship's Crew

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### ABSTRACT

Bullying is rampant and has severe effects on the health and wellbeing of the employees. Additionally, it also undermines job satisfaction and performance, thus affecting productivity. Bullying among seafarers is widespread, and their isolation from the rest of the people while at sea can enhance aggressive behaviour. Bullying is widespread among seafarers and severely affects them in core areas of their life. There is a significant effect of bullying on mental health. However, the Omani seafarers are loyal to their jobs and claim to be happy at sea despite the challenges and hardships. While there are different forms of bullying in the workplace, verbal abuse is the most rampant. The study seeks to highlight the impact of bullying on seafarers' happiness and job satisfaction who work in a shipping company. A questionnaire with nine questions was prepared based on the authors' experience and sent by mobile phone to fifty officers and crew members working onboard. More insight into workplace bullying among seafarers is essential in formulating adequate law, thus improving seafarers' health and safety.

## 1. Introduction

Health and safety are essential requirements for on-shore work environments. On the other hand, occupational safety in offshore environments is even more critical since it deals with the unique challenges of working at sea. The shipping environment is a challenging workplace because people who have never met before are required to suddenly start working together as a cohesive unit, establish common communication channels and conduct day-to-day operations all while living removed from the rest of the world. In such an environment, ergonomics and human health have increasingly gained concern in recent years. Among seafarers' issues, bullying and harassment are critical ergonomic concerns <sup>[1]</sup>.

Bullying at work is the continuous and prolonged verbal or psychological against an individual by his co-worker or a group of co-workers in such a way that it negatively impacts and isolates the individual <sup>[2]</sup>. For the individual, bullying results in loss of self-esteem, lack of confidence, fear, psychological and mental distress, and performance loss. It is also a significant safety risk because the cognitive effects of bullying cause the victim to lose alertness while at work, leading to errors and catastrophic accidents. It is equivalent to the loss of one worker to the team since the worker performance and the team cohesiveness are affected. It may even result in musculoskeletal disorders.

Additionally, in a complex and enclosed environment,

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it is challenging to gain privacy or anonymity to respond appropriately to research attempts by those on the mainland.

Inner peace, mental health, and happiness are essential to sustain the individual's good performance and the entire unit, at sea or otherwise. It is crucial to study the extent, effects, and controls of bullying to prevent and improve work quality.

There is an excellent risk of seamen bullying because they are already under significant psychological stresses due to the job demands, which adds to the loneliness and separation from home, letting them lose good moral behaviours and act aggressively against each other. Bullying was mentioned to have humiliating effects on the victims and led to untreatable symptoms. Workplace bullying causes loss of productivity and performance and stress, depression, insomnia, and anxiety<sup>[3]</sup>.

Additionally, it can also lead to financial compensations to cover any losses sustained by the victim or resolve harassment cases. The shipping industry recognizes the impact and likelihood of bullying, but we need to thoroughly investigate its effects.

A researcher investigated the impact of various factors related to the occupational environment on job satisfaction and intention to leave the job. They carried out the study by marking the difference between European and Filipino workers. Harassment was one of the work environment factors considered a characteristic that could influence employees' job satisfaction<sup>[4]</sup>. The effects of harassment directly cause decreasing job satisfaction and an increasing intent to leave the job. This study was conducted by specifically surveying employees working in the maritime industries.

Bullying at sea is strongly related to the loss of happiness and other long-term effects, regardless of the scenario. Since the victim is out of sight of supporting individuals at sea, the impact may seem more severe. Bullying is known to have detrimental effects on the health and well-being of the individual. Ultimately, bullying results in safety concern for entire units, dangerous in high-risk marine environments. Studies related to bullying at sea, the consequences, and controls are minimal, especially related to the Omani work scenario.

Understanding aspects of bullying can lead to better regulations and better management of such concern, thereby enhancing the overall health and safety onboard the ship.

## 2. Literature Review

A study referred to bullying as “covert aggression” as it is not immediately apparent and can cause a more

severe impact on the victim<sup>[5]</sup>. Bullying at the workplace includes all sadistic and unreasonable work practices directed at an individual or group of individuals that negatively affect their self-esteem and mental health. Bullying impacts the psychological well-being of humans. The growing recognition of health and safety in workplaces has revealed the hidden issue of bullying and its impact, including sadistic comments veiled behind jokes frequently aimed at individuals or groups at workplaces. However, there is also a misconception that physical assault and resulting trauma have a more significant negative impact on health and well-being than verbal bullying or other covert forms of occupational violence. The investigators studied the same by surveying over eight hundred employees in Australia. The authors proved that bullying resulted in mental health impacts that were equivalent to the trauma from being physically assaulted.

Bullying frequency, causes, and impact were investigated in the context of restaurants and commercial kitchens. They conducted an extensive literature review to determine why workers, especially chefs, in commercial kitchens are subject to a lot of bullying while working. They further found very little information published regarding the causes and effects of bullying in commercial kitchens<sup>[6]</sup>.

Seafarers are exposing to high levels of risks due to the challenging work environments and the constant hazards of work at sea. Additionally, the demanding and isolating work environments introduced several stress factors in workers at sea that are detrimental to their mental health.

Shipping work environments are strife with psychological stress factors, which have been considered by the authorities and recommend acting by the Maritime Labour Convention held in 2006<sup>[7]</sup>.

This event introduced the Psychological General Well-Being Index (PGWBI) questionnaire that effectively measures maritime workers' psychological well-being in stressful scenarios. They conducted a study to establish the questionnaire's effectiveness and compare the mental effects on various groups of maritime employees such as engineer officers, deck officers, catering, ratings, etc. The study established the PGWBI questionnaire's suitability as a reliable tool for the assessment of stress and anxiety among seafarers. They found that stress levels were higher among engineer officers than to deck officers and other lower-level workers. When management levels go higher, the stress level rises. This increase could be because of the increasing responsibilities in challenging atmospheres and possibly challenging behaviours from subordinates. The psychological general well-being index was, however, not explicitly developed for Maritime workers<sup>[8]</sup>.

## 2.1 Effects of Bullying

A study measured the impact of bullying among health care workers to determine whether short-term or prolonged bullying resulted in increased chances of cardiovascular diseases and depression. The authors surveyed nearly six thousand hospital workers and found that bullying was strongly related to the incidence of depression in health care workers<sup>[9]</sup>.

Bullying leads to an increase in anxiety. Extreme anxiety is one of the tougher affective mediators of the relationship between psychosocial aspects of work and musculoskeletal disorders<sup>[10]</sup>.

Bullying at the NHS Trust workplace was investigated and reported by utilizing a survey<sup>[11]</sup>. The survey, which received a seventy percent response rate (one thousand one hundred and ten employees), revealed that most of the respondents had either experienced bullying or had witnessed someone bullied. The results indicate the perpetrator was a superior or manager and the victim was a subordinate. Sadly, support systems at the chosen workplace were inadequate. The results recommend providing good support facilities at workplaces for victims of bullying.

Another research covers bullying among nurses in Portugal and the effects of bullying on the relationship between various mental health disorders and bullying. One out of six participants experienced bullying in some form or the other in a study period of six months. Those bullied were forced to do menial tasks, stripped of appropriate responsibility, or replaced with unpleasant tasks and overburdened with heavy work<sup>[12]</sup>.

One-fourth of the maritime respondents experienced bullying or harassment in some form or the other at sea<sup>[13]</sup>. They conducted a study to determine seafarers' work environments in terms of ergonomic, health and safety, and psychosocial risks. Analysis of psychosocial factors began with the issue of harassment encountered on board. The seafarers ignored, not taken seriously, or experienced ridicule and patronizing at co-workers or superiors' hands. While a significant number of men had experienced harassment, the frequency was twice as high in women as in men.

Most men refused to accept women in superior positions from a Greek seafaring group survey<sup>[14]</sup>. While they were able to get that women in similar jobs had performed just as good as them, they did not view women as capable of reaching high positions in the maritime industry. This attitude can motivate men to demonstrate covert aggression against their female colleagues or downgrade their performance. Regularly, this translates as nothing but bullying, which can induce depression and stress and low

retention of female employees in maritime jobs.

Sometimes bullying and harassment are even institutional at a company. Systems for appraisal and promotion are routinely unfair to specific employees, and colleagues learn to act negatively as part of the corporate culture. It is all too easy in this environment for some seafarers to abuse the concepts of 'seafaring traditions' and 'shipboard discipline' to make others' lives miserable<sup>[15]</sup>.

The Maritime Labour Convention (MLC) of the International Labour Organization (ILO) was established in 2013 to present a body of rights for seafarers to avoid or reduce the likelihood of bullying and harassment.

## 3. Methodology & Data Collection

For this study, we use the quantitative and qualitative research designs allowing numerical data for a given set of parameters.

The way to obtain the data is through the desired survey tool from a selected source or sample population. Quantitative research design helps get hard facts that can enable to achieve conclusive results on a particular subject. Quantitative data are objective, and hence the inconsistencies in subjective opinions are eliminated to a large extent.

Qualitative information utilizes personal views from a selected sample population.

The limitations of this methodology are listed below:

(1) A limited group of people reached out who share similar characteristics regarding cultural and linguistic backgrounds.

(2) While quantitative surveys can get objective responses and definitive answers, the answers cannot be conclusive. There may be many factors beyond the list of options provided for the respondent to answer. Hence, it is always important to support a quantitative study with relevant qualitative research such as an interview.

(3) Since the sample population is surveyed directly within their work environments, their responses can also be less accurate or not honest due to the fear of being identified and reprimanded or identified by the bully and subject to additional attacks and aggressive behavior.

The research investigated bullying effects and happiness onboard ships based on the worker's perspectives. Hence the respondents could include victims of bullying and harassment, bystanders and bullies themselves. The target population for the survey was the crew of the researcher's ship. Most of the respondents were from the deck department. The questionnaire did not investigate the level to maintain complete anonymity.

The selected sample consisted of fifty seafarers on board the same ship as the researcher was. Sample siz-

ing did not follow any criteria and merely reflected the number of workers available for answering the survey. Hence the sampling technique is convenience sampling or non-probability type sampling. The sample population was selected based on the most comfortable access and availability and devoid of any strategic criteria. Permissions were obtained from senior officers on board to survey but by maintaining anonymity. The online tool Survey Monkey administered the survey as all workers had access to mobile phones with Wi-Fi connections and could quickly receive the questionnaire's links. Additionally, this also meant less waste generated.

#### 4. Results & Discussions

In this section, the findings of the survey are analysed by each question.

Figure 1 shows most of the respondents had experienced some form of harassment, bullying, or mistreatment in the last six months.

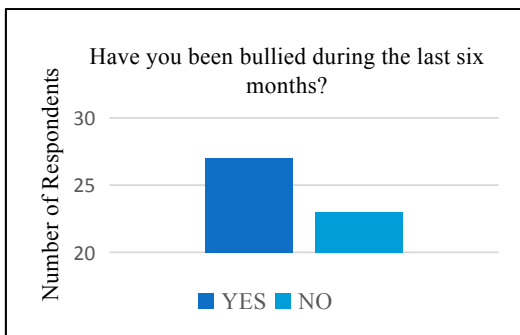


Figure 1. Recently bullied

Figure 2 indicates all the fifty respondents agreed that they had witnessed a colleague getting bullied at least once in their career.

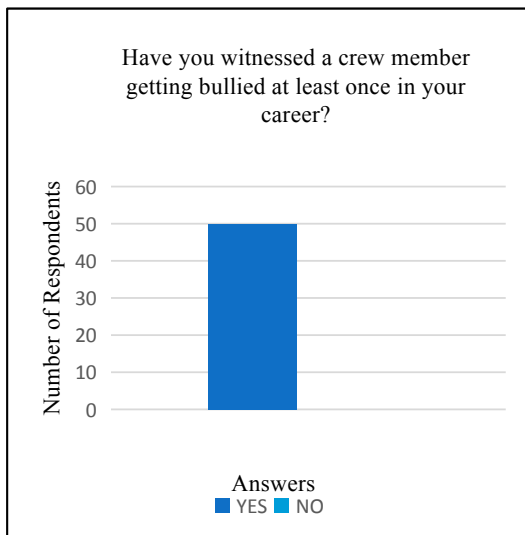


Figure 2. Evidence

Figure 3 indicates thirty-four respondents have experienced bullying or witnessed bullying by those at a higher rank. Others bullied Sixteen crew members at the same level.

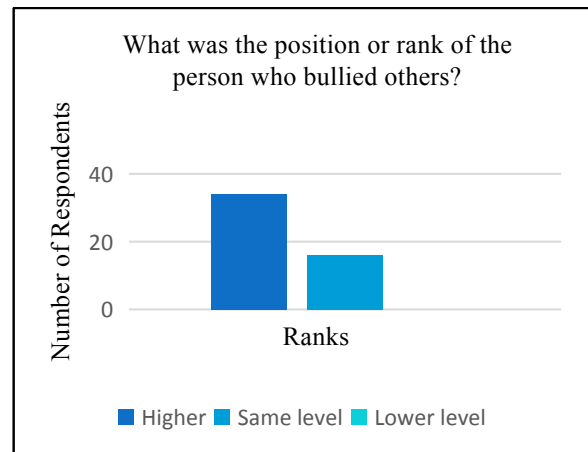


Figure 3. Rank/ Title

Figure 4 shows that verbal abuse (i) is the most common form of bullying activity, identified by twenty-eight respondents. Constant demeaning and humiliation (ii) were experienced by five of the respondents, and Seven respondents had experienced or witnessed isolation or labelling (iii). Undermining professional achievements and status was identified in eight responses (v), and two crew was attacked on workplace relationships (iv).

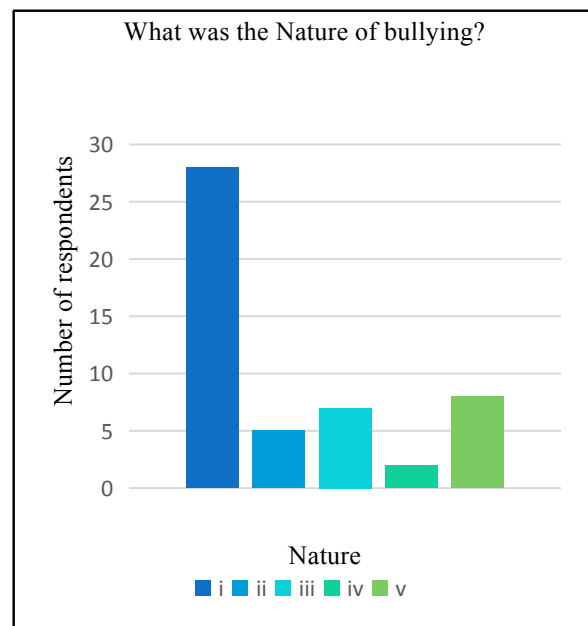
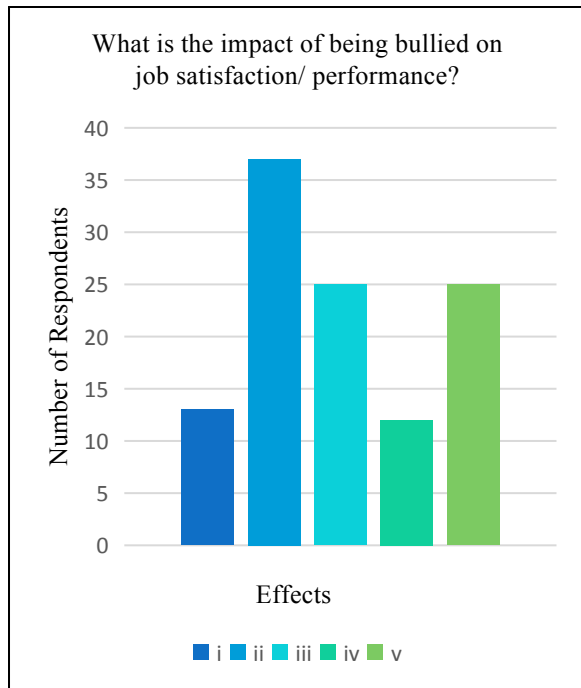


Figure 4. Different types of bullying

The effects of bullying are leave of absence (i), declining morale (ii), low productivity (iii), repeated attempts to change jobs (iv), and considering quitting (v). The respondents could select multiple options.

Figure 5 emphasized that a significant number of respondents displayed some form of dissatisfaction with their current jobs. While most did not go for sick leave, thirteen respondents had taken sick leave due to bullying or harassment effects. Thirty-seven crew faced with declining morale. Twenty-five crewmembers experienced Poor productivity. Half of the surveyed employees had thought of quitting the job, which demonstrates a high level of dissatisfaction with the work environment.

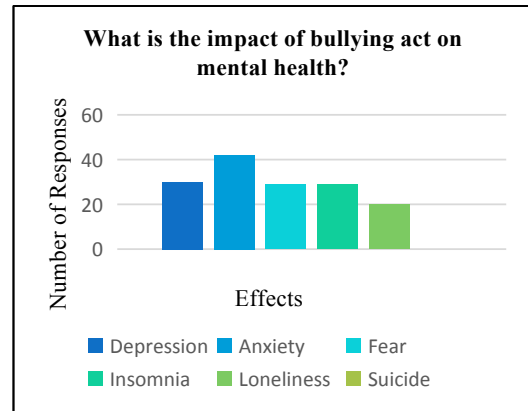


**Figure 5.** Impact on job

The most important question in the survey was the impact of the bullying act on mental health and happiness as it was directly related to the study's aim. The effects considered are:

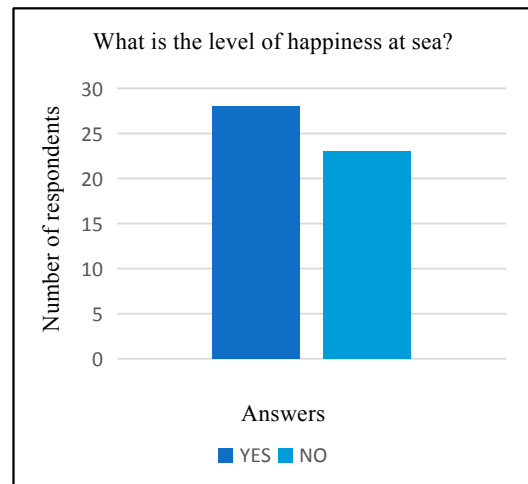
- i) Depression,
- ii) Anxiety,
- iii) Fear,
- iv) Insomnia,
- v) loneliness and,
- vi) suicidal thoughts.

Figure 6 shows that anxiety was highest, followed by depression. A significant number of respondents also experienced fear and insomnia. While twenty respondents had experienced loneliness, indicating a lack of adequate support systems in the workplace, three sailors had even thought of suicide. While the results do not mean that other factors may not influence the impact, it throws light on the fact that bullying is common and has a significant effect on the respondents.



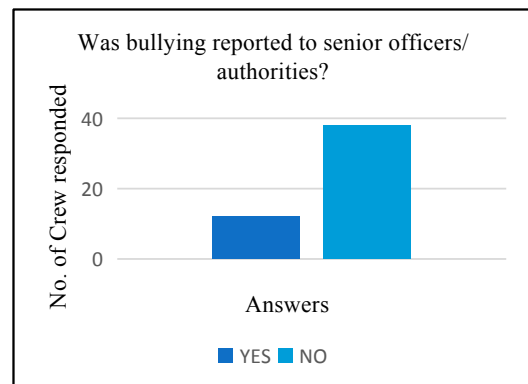
**Figure 6.** Mental health

As shown in Figure 7, the answers point to slightly higher responses for Yes and a lower number for No. We can see that seafarers are loyal to their jobs despite hardships faced in the middle of the sea.



**Figure 7.** Seafarer's happiness

Figure 8 indicates that only twenty-five percent of respondents reported a possible bullying case. Those who are not saying the case may fear the others to find out or repetition of bullying.



**Figure 8.** Reporting

Figure 9 shows out of the twelve cases reported, only five issues were taken seriously by the management. It is sad and reveals the lack of enough support systems and policies to prevent bullying.



**Figure 9.** Management's action

#### 4.1 Interviews Questions

(1) Have you witnessed a crew member getting bullied at least once in your career?

First Interviewee: Yes, once. Bosun was bullying a trainee seaman.

Second Interviewee: Yes, the third engineer, second engineer, and electrical officer used to bully the fourth engineer.

Third Interviewee: Yes, I did. I have witnessed it twice. The first time I noticed it between the third engineer and engine cadet. Both are from the same nationality, but the third engineer uses his rank authority to bully the poor cadet. The cadet should have reported or defended himself, but it looks like he was afraid of him. The second time I have seen it between the cadets of the same nationality. One of them was smart and followed the superior's orders in precise and on time. Still, the other two cadets were lazy and always late. Hence, they start bullying him significantly till the poor deck cadet asked for an emergency sign off without any valid reason.

(2) What is the impact of being bullied on job satisfaction/ performance?

First Interviewee: The Trainee seaman became seriously disturbed. He was unable to concentrate on his job. He was making more mistakes even while carrying out his day-to-day jobs.

Second Interviewee: Performance will be affected, and there will not be job satisfaction even if you perform well.

Third Interviewee: Once you get bullied on your job, it

will always impact your output and performance. For example, every time you join a vessel with high motivation and expectations, you are forced to move away from your goals and vision for future life at sea once you are getting bullied. Getting bullied keep a person isolated and reduces his/ her efficiency.

(3) How is the impact of bullying act on mental health?

First Interviewee: Mentally, a person becomes unstable. He/ she loses his confidence and tries to avoid being in the group and prefers to stay alone, and if this continues, then it is a high chance for that person to go into depression.

Second Interviewee: It may lead to depression if no one acts or supports the person getting bullied.

Third Interviewee: It is a common factor that bullying has an impact on mental health as well as physical fitness. Bullying will keep you isolated from others and not socialize with people and keep your mind in a state where you will always be thinking about avoiding bullying or running from the bullying people.

(4) What is the level of happiness at sea?

First Interviewee: Happiness at sea comes with all small things. A respected, friendly atmosphere is necessary to create joy and happiness. On-board satisfaction and happiness are severe to maintain as personnel are away from their loved ones. However, people are encouraged to laugh and reduce stress by talking about various topics other than shipping.

Second Interviewee: Level of happiness depends on dealing with the other crew and relation between them. If everyone is friendly and helpful to each other, happiness grows, and performance improves.

Third Interviewee: It depends on how you define happiness; the level of joy differs from person to the other. It starts with how you end up in this field, whereby self-wish, and ambition or by luck or just because you forced to end here. It was an ambition to become a mariner and raise the Oman flag and be part of the national organization to reach a high level of success in the marine field where no one has run before. On the other hand, you must make sacrifices for your families and social life to reach your final goals. Life at sea is not easy and not hard, and it depends on how to deal with it.

(5) Did management take any action on receiving a bullying case?

First Interviewee: Unfortunately, nobody reported bullying to the management due to fear of losing the job.

Second Interviewee: On-board management will act only if they care about the crew and their welfare.

Third Interviewee: It is a common factor that bullying has an impact on mental health as well as physical fitness. Bullying will keep you isolated from others and not so-

cialize with people and keep your mind in a state where you will always be thinking about avoiding bullying or running from the bullying people.

(6) Have you done any training to deal with bullying?

First Interviewee: Negative, however self-had been part of Anti Ragging campaign and had taken a position on these types of the seminar.

Second Interviewee: No.

Third Interviewee: I have not done any training on bullying from the company, but I have read some books on protecting yourself and your kids from bullying at school or work.

(7) Do you have a suggestion to avoid bullying?

First Interviewee: Bullying can be stopped or avoided if people on top management assure the officers and crew that they can approach them directly. Top management should take it up personally to check that people are happy. They should stop believing people blindfolded. If any matter comes to them, they should tackle it, approach it with sensitivity and not just plainly ignore it.

Second Interviewee: The Captain and onboard management's responsibility is to take care of their sub-ordinates and encourage all crew to work as a team rather than commitment alone.

Third Interviewee: I suggest making a big campaign among fleet vessels to familiarize them with bullying. Show them the correct way to report to the company so management can act against it. The campaign will also teach people how to protect themselves and overcome bullying.

Many of the respondents experienced bullying or harassment of some kind aboard the ship. However, all the respondents witnessed some form of bullying, either on an officer or on a lower-level sailor.

As expected, most of the bullies or perpetrators of harassment were higher-level employees on subordinate or lower-level victims. It could be a misuse of authority or merely prevention of outperformance by the subordinate. It also supports the literature that higher-level employees tend to bully subordinates, which is a common form of bullying in workplaces.

Verbal abuse was the most common form of bullying. It can impact the confidence or self-esteem of individuals or even instil fear in them.

Our findings indicate a severe bullying effect on job satisfaction. The impact on psychological health was evident.

Management found not to be supportive of bullying victims from the present study. The crew reported only a few cases, and the administration responded to fewer issues. It shows a need for a more in-depth investigation

into bullying aboard the ship and a need for determining the critical control systems to prevent or minimize such actions in the future.

## 5. Conclusions and Recommendations

The literature review found that the prevalence of bullying was high in workplaces, especially in demanding shipping work environments. The examination further revealed several impacts of bullying on worker psychological health and well-being, amidst a few studies.

The following recommendations will improve the seafarers' happiness and mental health aboard ships and minimize bullying.

(1) Management should investigate in more detail the extent and negative impact of bullying.

(2) Support systems should be employed to support bullying victims and allow them to act in case of repeated abuse.

(3) A friendly, respected, and disciplined working environment avoids creating an atmosphere of panic or instilling a feeling of being watched.

(4) Motivating seafarers improve cohesion among employees and a sense of belongingness to the work environment.

(5) Consider and adopt bullying as item nineteen of breaches of the code of conduct that could lead to the offender's dismissal.

(6) Maritime colleges to train cadets about bullying. It can be in the human resource management (HRM) module for officers and engineers or short courses for ratings.

(7) To keep a copy of "International Guidance on Eliminating Shipboard Harassment & Bullying" published by the international chamber of shipping (ICS) & the international trade federation (ITF) on board.

(8) To enable the crew to complain about bullying in all ports around the world to ITF.

(9) Add it as a new item in the complaint procedure (in the company manual)

(10) To develop guidelines for filling up the complaint report.

(11) Every flag inspector should have a meeting with the crew to discuss the presence of bullying onboard.

(12) Every class inspector should have a meeting with the crew to discuss such cases.

(13) To inform seafarers of their right to report when bullied by another crew member.

(14) Encourage seafarers to fill up a complaint form and discuss any complaints in the ship management meetings.

(15) To follow recommendations and guidelines from protection and indemnity (P&I) clubs.

(16) Refer to ECSA/ETF (European Community Ship-

owners' Associations/ European Transport Workers' Federation) Guidelines to Shipping Companies on Equality of Opportunity and Diversity in the European Shipping Industry.

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**ARTICLE**

# **Welfare for the Aged in Nigeria, a Sustenance for the Declining Older Population and Aged Male in Nigeria**

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Elixir for contraction in elderly populace in Nigeria

**ABSTRACT**

A buttress on the need for welfare program in Nigeria and the important obligation to consider the Economics' and CIA's contextual position for the dependency ratios, both total and elderly dependency ratio alongside the consideration of the age structure and demography statistics of Nigeria relatively to other economies, particularly as an elixir for the declining older population in Nigeria and the aged male contraction in the nation. Although, older female population is higher in every country as obtainable globally, the Nigerian case is that of drastic contraction in both aged male and older population generally. Therefore, the submission is that the government has to consider the total dependency ratio to the elderly dependency ratio, which is all-encompassing in order to cater for the declining older population and to appropriate the requisite welfare cum benefits programs in the nation.

## **1. A Consideration of Economics and CIA's Context of Dependency Ratio and Age Structure**

In global economics, it is obtainable that Germany has one of the highest aged population in the world such that the government is appealing to the younger generation to get married and give birth, the rationale behind why the German government gives welfare and huge benefits monthly to parents according to the number of your offspring, the aged men and women in the country are enjoying longevity, due to the developed economy, a viable medical facility and policy, and feasible welfare program for the aged. The more reason why we see a lot of them

even with their partners during the summer in Cyprus and Turkey as tourists, trying to enjoy the rest of their lives and what they have laboured for. Entrepreneurs with initiatives have submitted that to venture into a business, make sure it is a business that would be patronised by the aged, then it is sure that the business will survive. The aged have worked and seen it all, so the remainder of their lives they always make sure they enjoy it, do or get the necessary things of life, hence a business that the old do not patronise is half-likely to succeed. The old always make sure they have call credits on their phones, they eat good and healthy food, their health and wellness are paramount to them, they like going to secure places and all the sorts. Therefore, innovative entrepreneurs looking for a successful business target

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the long-living citizens.

Nevertheless, the concern is about the old in Nigeria, taking a look at the statistical data and report as shown in figures below of the CIA, Central Intelligence Agency, WorldFact Book about Nigerian population during and on the occasion of several studies about Nigerian economy, demography cum polity is very expository. Although, it is widely known and stated even on Wikipedia that Nigeria is one of the top countries with high population of youth, it is also available from CIA World Report that Nigeria is one of the countries with a teeming younger generation which has the highest number of males above females' population<sup>[3]</sup>, several countries have female population towering above the male. In America, in their population statistics for most states and cities, the number of females is higher than that of their male counterparts, it is available online for confirmation same as that of Nigeria below. Nevertheless, globally, population of the female is said to be higher than male. But, noticeably in the Nigerian population statistics, for the younger population below 50 years, the males are more than the females while for the category of 50-60 years and 60 above, the aged females are more than the males. The question is, where are all the aged and old men in Nigeria going or what is happening to them? Medically and globally, apart from females been confirmed to be more in population, they have been posited to live longer than the males, even from several research<sup>[10]</sup> but the reduction rate of the aged male and the old generally in Nigeria is alarming according to the attendant statistics of the CIA World Report for the Nigerian section<sup>[3]</sup>, this shows that there is imminent cause for the decline in the aged and elderly male population in Nigeria. Another important thing of note is that Nigerian aged citizens are drastically reducing and very low in comparison to other nations showing high mortality rate for the old citizens, a low survival rate as obtainable in the statistics, the reason there exists only 6 million aged citizenry as at 2018 from a population of 203 million, that is tantamount to 3% of the absolute population, a meagre portion of the whole populace as elderly citizens. This is why Nigeria, the seventh most populous globally is never categorized as one of the nations with the largest elderly populace, which is not supposed to be the situation if medical facilities and welfare program were actively in place<sup>[7]</sup>.

However, Nigeria is still one of the countries with low women empowerment, inadequate medical facilities, although the Lagos state Government and some states are trying about free medical facilities, particularly for age 60 years and above, but the aged need better welfare cum benefits program than just the insufficient medical infrastructures and amenities they are entitled to. Hence, because of the low women empowerment in Nigeria, most of the family responsibilities lie on the man as the bread-

winner, which makes the men labour and toil more to provide basic needs for the family, these and the necessary family provisions are what stand as the factors weighing down our Nigerian men to inadvertently depreciate and diminish in numbers as they grow old. The burden on Nigerian fathers are still much due to the fact that there is no basic welfare to support their requisite provisions for existing families. Inadvertently, we still have some fathers who fall in the category of having more than one wives, hence numerous children, more so, there exist the group of fathers who still believe the wife's duties remain in the kitchen which makes the husband the sole provider of the family while the wife mans the kitchen and caters for the kids well-being in terms of taking care of them making all basic needs' responsibility lie on the shoulder of the men.

Therefore, part of welfare program necessary in Nigeria is women empowerment which goes a long way to help and ease the burden on the Nigerian husbands and fathers in the labour to meet family needs and expectations as touching making available the necessities of life for their immediate and extended families, these fathers need help to reduce the diminishing aged men in the population as found in the demographic statistics. The fact remains women who do not realise early the need to support their husbands in responsibilities would be compelled to do so when the man of the house is ailing or gone to the other side of the great divide, the land of no return. Therefore, we need to help the falling population of our aged and elderly men equally reducing the number of widows, which can only be achieved by a feasible welfare and benefits program in place, instituted to support parents. Nigeria does not have a functional old peoples' home where government or agency house old people with paid carers to take care of ailing and vulnerable aged populace. These and many more are available in nations around the globe to cater for ailing or susceptible old citizens. It reduces burden on the kids, and helps to save the lives of the nations' elderlies. One important fact that we have to realize about the aged is that these are people who have actually contributed to an economy largely, living in a land for over six decades where they engaged in economic activities, achieving the basic needs daily which are the known feeding, housing and clothing, not only for themselves but with families as hangers-on, not to mention secondary needs like education, personal and family health maintenance, hence they spend money daily which goes to both private and public sector coffers, their over the years contribution in an economy is worth to be rewarded and that is with an adequate benefits policy.

Most of these parents who have suffered to train their kids through school and university education denying themselves of personal gratification for the purpose of educating their

children are now at the mercies of their kids, the interesting but sad case is when any of these aged parents fall sick, the kids' however indirect prayer is for their quick death to relieve them of the stress even though these are senior citizens who have painstakingly laboured for the reason of the education of their offspring. This is not the case with first-world nations. The efforts and programs of aged welfare department or office in advanced nations or first commonwealth countries are commendable and noteworthy, they have so much planned and mapped out the welfare program in such a way that the lives and existence of the aged is independent of their children, hence no aged parent lives at the mercy of their kids, equally making survival of their kids tied to the existence of their beneficial aged parent. Therefore, children do not neglect or maltreat their fathers and mothers who have gone through a lot to train them in their weak days, because, apart from being entitled to financial benefits, they are entitled to housing benefits and utility allowances. More so, in some top commonwealth nations, any of their kids who volunteer to take care of them when ailing or ill would be paid monthly by the care program office or agency. Therefore, mature kids benefiting directly or indirectly via their parents will not abandon such parent, or pray they die when they are sick even with minor or major sickness. This is the case when a viable welfare policy is in place for the laboured senior citizenry.

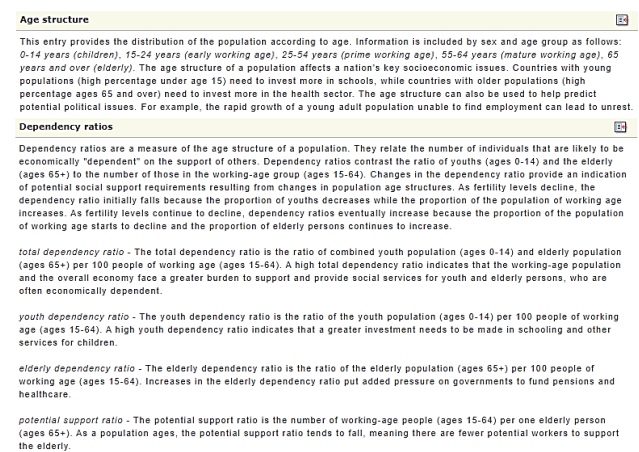
Part of welfare structures visible even in many European cities and in Istanbul, Turkey as touching Urban Economics and planning is the consideration for the aged in buses, trains and many-core places, the rationale behind why as big as the Istanbul city from the Anatolian to the European, the city is planned to give easy movement to the elderly even as pedestrian or on wheelchair or with walking aid. There are escalators in buildings and in the cities, same as lifts in middle of the cities for easy movement for the old populace. More so, within the cities are fewer steps and more frictional-floored steps to aid their movement. The more reason why you see lots of old people out and about taking a stroll and moving around as obtainable in Europe and advanced countries. While LDCs and low-income countries are at the stage where most of the senior citizens are retired in their homes and the society treats them like they are not supposed to leave the four walls of their houses, facilitating their deaths. The care for the aged is paramount, as the fact remains we will all get to that stage, but the precedence laid now will be improved and there is utmost need to approach these programs as these set of people have been contributory to the economy and still beneficial even in their weak days. Let us employ the approach that will make us see each other and our parents in a long time in good health.

Some of these old citizens for the sake of sustainability,

especially those who still bear family burdens engage in petty trading or business for the purpose of family sustenance, the rationale behind their petty trading or retailing to final consumers in their immediate environments, others without business engage in subsistence activities with the little funds available to them, these show that any benefits program accorded them are sure to be re-injected into the economy within days of disbursements or benefitting from the program either for those engaging in micro-trading or subsistent living. The reason why welfare program is beneficial to the economy as the funds are in circulation and forms an economic cum monetary or financial cycle in a nation increasing the flow of funds and GDP in the national income accounting, causing or having a multiplier effect on the economy and income. There is urgent need to come to the aid of the declining aged and elderly male in the country as sure evident.



**Figure 1.** Showing CIA's WorldFact Book population classification of Nigerian age structure and dependency ratio



**Figure 2.** Indicating CIA's general context definition of age structures and dependency ratios for all countries

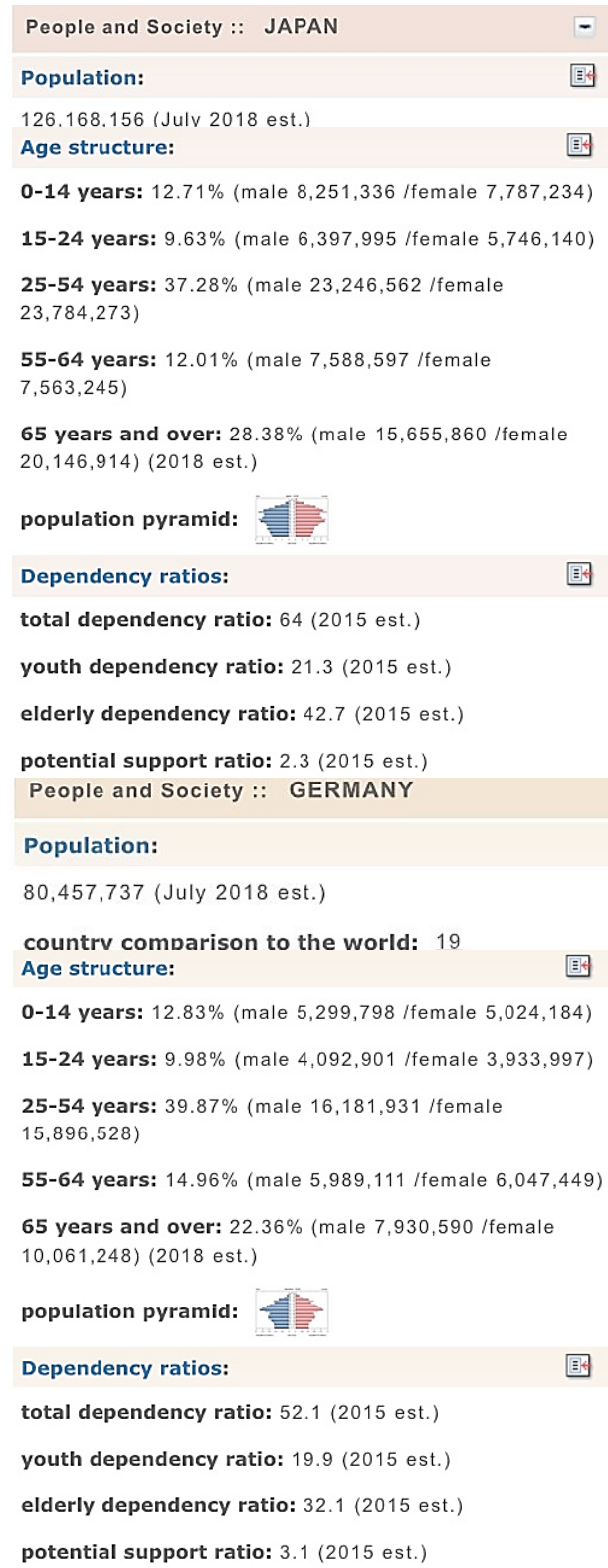
Above are pictures showing Nigerian population, age structure and pyramid with the dependency ratios as it would be compared relatively to selected countries below. Also, is the CIA's general contextual definition of age structure and dependency ratios for clearer comparison of nations <sup>[3]</sup>.

## 2. Theoretical Perspective of CIA's Demographic Analysis of Other Nations Relative to Nigeria

Adisa (2019) submitted that the aged in Nigeria are vulnerable compared to other nations <sup>[6]</sup>. Considering the definition of dependency ratio tells a lot about why Nigeria as a nation has very few old populace relative to what is obtainable in other countries as seen in the figures below, even though it is clear-cut that these economies are not near Nigerian population. More so, considering the percentage of the aged citizenry in the age structure classification as reflective in the picture above shows the nation is drastically suffering and experiencing massive reduction in its elderly citizenry. These as stipulated in the dependency context are as a result of poor medical facilities, inadequate pension programme, and more importantly, absence of evitable welfare cum benefits policy, even as posited by Perpetua et al. <sup>[7]</sup>. Another major cause of high dependency ratio is unemployment, as the ratio is calculated contrasting the dependent populace relative to the independent or working set of the citizenry. Also, as the ratio is derived comparing a group of the population to the other showing though there is positive increase in the population but there is high mortality or death rate in the country indicating poor medical infrastructure prevalent in the nation, particularly, a polity lacking safety and survival structures as it is in Development Economics which posits that developing nations experience high death or mortality rate and low fertility or birth rate, more so high death rate at birth resulting from inefficient medical amenities or attendance of viable medical facilities to sustain survival and at birth.

Below are illustrations from selected countries which are high-income economies and presumptuously with population not up to Nigerian populace, their age-structure pyramids, a result of graphical age group representations which show their age classes and percentage composition with illustrative total dependency ratio as it compares how the level of Nigerian demography stands with these nations. From the below pictures of the selected countries examining their age categorisation, percentages of the age groups and the age-structure pyramid illustrations enunciate a lot, Japan and Germany figures and age structure with the pictorial pyramid show higher percentages of the old populace to the youth in the countries same as what

is almost the status quo in France and United kingdom as seen in the pictures below, countries with populace tantamount to 120- to 80,000 65,000 and 55,000 respectively.



**Figure 3.** A picture of the population, age structures and total dependency ratios of Germany and Japan

**Population:**

67,364,357 (July 2018 est.)

**note:** the above figure is for metropolitan France and five overseas regions; the metropolitan France population is 62,814,233

**Age structure:****0-14 years:** 18.48% (male 6,366,789 /female 6,082,729)**15-24 years:** 11.8% (male 4,065,780 /female 3,884,488)**25-54 years:** 37.48% (male 12,731,825 /female 12,515,501)**55-64 years:** 12.42% (male 4,035,073 /female 4,331,751)**65 years and over:** 19.82% (male 5,781,410 /female 7,569,011) (2018 est.)**population pyramid:****Dependency ratios:****total dependency ratio:** 59.2 (2015 est.)**youth dependency ratio:** 29.1 (2015 est.)**elderly dependency ratio:** 30.2 (2015 est.)**potential support ratio:** 3.3 (2015 est.)**Population:**

65,105,246 United Kingdom (July 2018 est.)

**Age structure:****0-14 years:** 17.59% (male 5,871,268 /female 5,582,107)**15-24 years:** 11.71% (male 3,895,850 /female 3,726,311)**25-54 years:** 40.29% (male 13,387,119 /female 12,843,549)**55-64 years:** 12.22% (male 3,936,466 /female 4,022,245)**65 years and over:** 18.19% (male 5,321,392 /female 6,518,939) (2018 est.)**population pyramid:****Dependency ratios:****total dependency ratio:** 55.5 (2015 est.)**youth dependency ratio:** 27.4 (2015 est.)**elderly dependency ratio:** 28.2 (2015 est.)**potential support ratio:** 3.5 (2015 est.)

**Figure 4.** Illustration of the population, structures and total dependency ratios of France and United Kingdom

The pictorial representation above show population structures of four giant economies with peculiarities of falling in the group of high-income and first-world na-

tions, particularly with two of them (UK and France) having almost-same population and they are all figures far lower compared to Nigerian data, but they are economies with earmarked budgetary allocation for the care cum benefits of their elderly citizens and are equally concerned about the ageing of the citizenry as enunciated by Alan Walker, (2017) in his work suggesting a public policy to help ageing process in UK and globally<sup>[1]</sup>.

**Population:**

35,881,659 (July 2018 est.)

**country comparison to the world:** 38**Nationality:****noun:** Canadian(s)**adjective:** Canadian**Ethnic groups:**

Canadian 32.3%, English 18.3%, Scottish 13.9%, French 13.6%, Irish 13.4%, German 9.6%, Chinese 5.1%, Italian 4.6%, North American Indian 4.4%, East Indian 4%, other 51.6% (2016 est.)

**note:** percentages add up to more than 100% because respondents were able to identify more than one ethnic origin

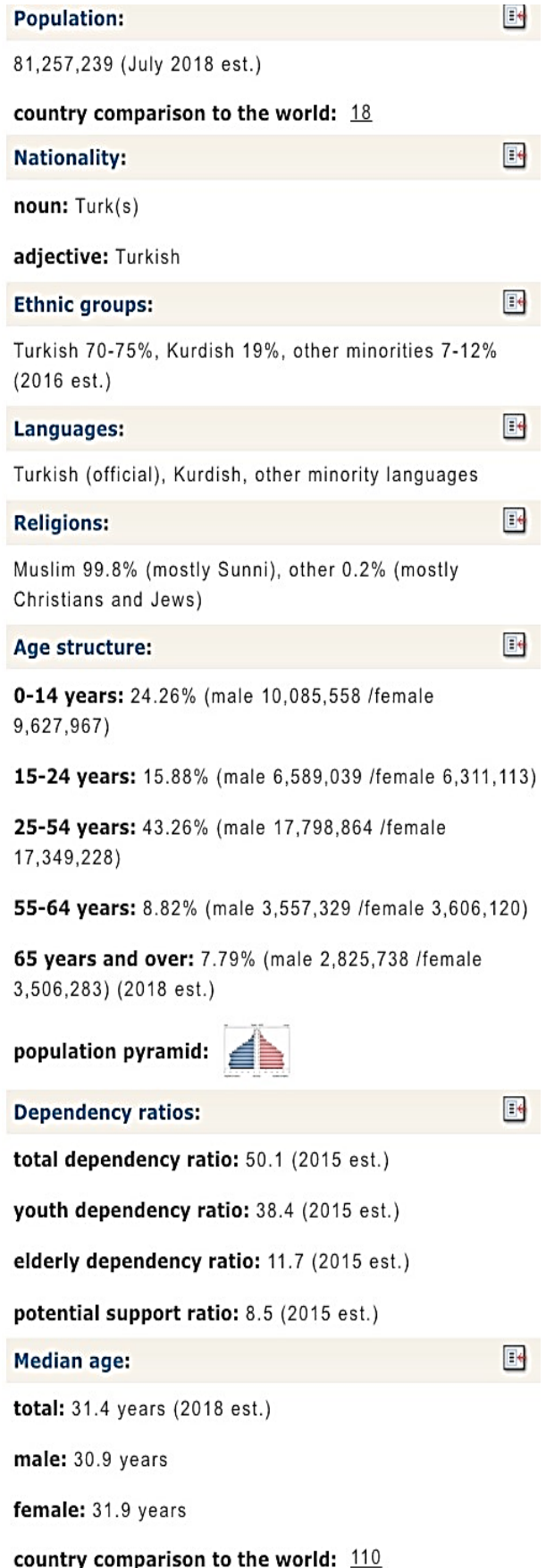
**Languages:**

English (official) 58.7%, French (official) 22%, Punjabi 1.4%, Italian 1.3%, Spanish 1.3%, German 1.3%, Cantonese 1.2%, Tagalog 1.2%, Arabic 1.1%, other 10.5% (2011 est.)

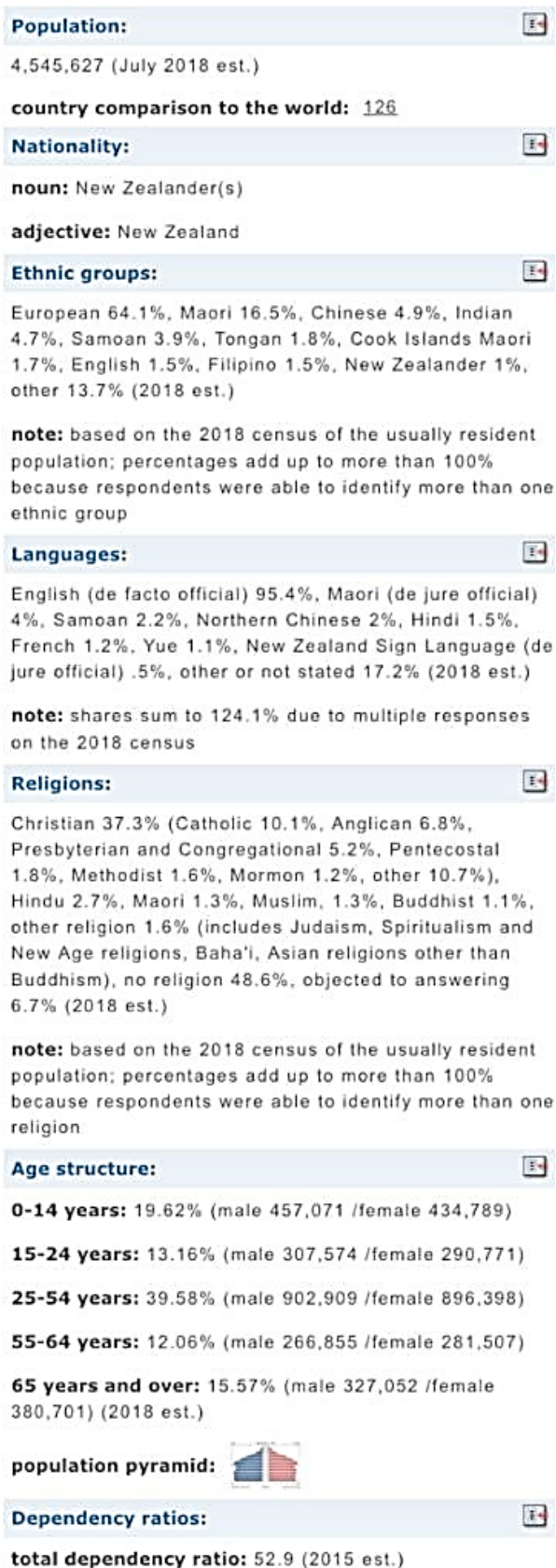
**Religions:**

Catholic 39% (includes Roman Catholic 38.8%, other Catholic .2%), Protestant 20.3% (includes United Church 6.1%, Anglican 5%, Baptist 1.9%, Lutheran 1.5%, Pentecostal 1.5%, Presbyterian 1.4%, other Protestant 2.9%), Orthodox 1.6%, other Christian 6.3%, Muslim 3.2%, Hindu 1.5%, Sikh 1.4%, Buddhist 1.1%, Jewish 1%, other 0.6%, none 23.9% (2011 est.)

**Age structure:****0-14 years:** 15.43% (male 2,839,236 /female 2,698,592)**15-24 years:** 11.62% (male 2,145,626 /female 2,023,369)**25-54 years:** 39.62% (male 7,215,261 /female 7,002,546)**55-64 years:** 14.24% (male 2,538,820 /female 2,570,709)**65 years and over:** 19.08% (male 3,055,560 /female 3,791,940) (2018 est.)**population pyramid:****Dependency ratios:****total dependency ratio:** 47.3 (2015 est.)



**Figure 5.** Illustration of the population, age structures and total dependency ratios of Australia and Canada



**Figure 6.** Illustration of the population, age structures and total dependency ratios of Turkey and New Zealand

Looking at the Nigerian age structure pyramid (graph) relative to all other pyramids from the pictorial illustrations above, the Nigerian pyramid is very illustrative of the Nigerian survival, mortality cum fertility rate existent in the polity, it shows there is high death rate, a significant low survival rate for the burgeoning youth population which indicates that Nigerian population decreases as the age of the citizens increase, particularly after the youthful age, a reflection of the inadequate health facilities and infrastructures with poor welfare program for the aged. Gusmano and Okma (2018), stipulated that although the elderly obviously need external support to meet up with daily living and maintenance, but the predominant case is that of neglect and unaffordability of social program to cater for their well-being<sup>[5]</sup>, the rationale behind the contraction in the population of the aged. More so, the dependency ratio shows all other countries have low dependency ratios and minimal total dependency ratios which means the aged and the younger population have low reliant on the working population, a paradigm of feasible empowerment and benefits program in place. It is obtainable in Development Economics that underdeveloped countries and nations who fall under the category of poor or low-income nations and in the group of LDCs suffer from low life expectancy. This is what is available in Nigeria, a nation that has been upgraded to the class of lower-middle income economies and a predominant market economy still operating in the stage of LDCs. Out of the examined nations, Nigeria has the highest dependency ratio, all the other countries have average dependency ratio of 50% except for Japan, while Nigeria's ratio is 88% as at 2015, a significant indication that the aged and the younger youth generation are absolutely dependent on the working class, a burden on the working population and a prerequisite for the need for government provision of health, welfare and pension program, the reason why the population of Nigeria decreases drastically from the workforce age category, this is due to the burden on them with little support from the government, inefficient health infrastructure and lack of aged benefits policy, and the rationale behind why the elderly in Nigeria get little support from their kids, this causes diminishing elderly populace to set in. Found in the article on national policies and programs for the elderly in India, the author stated several instituted policies as present in the Indian constitution for the care of the ageing populace with a caveat that children who do not take good care of their aged are seen as offenders and liable to punishment, also mentioned how the program has been implemented in 22 states and across different sectors in the nation<sup>[8]</sup>. Japan is 120 million in terms of population, Turkey is 80 million, but both nations have higher number

of aged population than Nigeria with 203 million citizenries, even New Zealand with 4.5 million has far higher percentage to Nigeria, the paradigm of contributory and promotional provision of care program, just as Carroll (2006) says welfare reform has both direct and indirect effects on the elderly <sup>[2]</sup>.

The result from across countries shows that women live longer and outlive their male counterparts especially from age 65 above. The more reason why this work used the evaluation from age 65 above as the age of fully retired elderly citizens, and the age class 55-64 is not included, as it is the age bracket where most of the mature citizens are just retiring, and some of them still have little responsibilities while others are still acclimatizing themselves with retirement life or lifestyle. Looking at the population distribution, the number of males from most countries is still struggling to meet up with their female at 55-64 years, but for the age group 65 beyond, even for every country, the population of female towers that of the male. This indicates that most males apart from not surviving till the retirement age, more importantly, do not survive beyond the retirement age as compared to women. A result showing they have been used to the life of struggle, therefore not used to idle retirement life. In Nigeria, it is the case of retirement with little resources to survive, hence most of the men, including the women do not survive that age period, however better for the women, not to mention the psychological cause of death of the aged in Nigeria which is largely due to job and income insecurity, particularly predominant in those who fall into workforce in the financial cum banking sector with prevalence of unexpected job loss, cutting short their expectations of meeting basic needs of themselves and their immediate families, that is the more reason why Madero-Cabib et al. (2019) stated categorically in their research analysis result

that the generosity or robustness of a welfare policy is promotional to good- and equally prevent adverse health in old age, more so before, during and after retirement life <sup>[4]</sup>. Also, from the data available on CIA FactBook, as of 2015 estimate, Nigeria has the lowest elderly dependency ratio from the group of nations observed above, followed by Turkey while Japan has the highest with Germany as next. A high elderly dependency ratio instigates and pressure government to provide welfare program for the aged. Nevertheless, the relatively low elderly dependency ratio is not an achievement for Nigeria as it reflects that the aged populace is so low in the nation that the government does not have pressure to provide pension, benefit or healthcare program for the old, this is highly inappropriate in a population of over 200 million citizens, whereas Nigeria has the highest total dependency ratio to the rest of the countries because of the gargantuan prevalence of youth population indicating need for both youth and elderly care policies. Therefore, the public administration in Nigeria has to put into consideration the total dependency ratio over the elderly dependency ratio to implement an integrated aged support benefits and programs, this is the case supposedly preeminent due to the imminently low old citizenry, and this has been appropriated in other nations examined above. Sutthichai (2009) in his article entitled "National Policies and Programs for the Aging Population in Thailand" submitted that the care of the elderly is the responsibilities of the private cum public sector, and the municipality where the aged is domicile. <sup>[9]</sup>

### 3. Conclusions

It is preeminent that women live longer than the men as it is available in most countries' data in the CIA World-Fact Book, but the case of Nigeria needs attention and attendance as it cannot continue to be like this that in a

**Table 1.** table illustrating age structures and percentages from across the selected countries.

| Population Structure / Country | Total Pop. in Millions (M) | Total Pop of Aged from 65+ years(M) | Percent of Aged Pop 65+ years (%) | Aged Male Populatin 65+ yrs (M) | Percent of Aged Male, 65+ (%) | Aged Female Pop. 65+ yrs (M) | Percent of Aged Female, 65+ (%) | Total Depndcy ratio (%) | Elderly Depndn. Ratio |
|--------------------------------|----------------------------|-------------------------------------|-----------------------------------|---------------------------------|-------------------------------|------------------------------|---------------------------------|-------------------------|-----------------------|
| Nigeria                        | 203.5                      | 6.6                                 | 3.3                               | 3.1                             | 1.5                           | 3.5                          | 1.8                             | 88.2                    | 5.1                   |
| Japan                          | 126                        | 35.8                                | 28.4                              | 15.7                            | 12.5                          | 20.1                         | 16                              | 64                      | 42.7                  |
| Germany                        | 80.5                       | 18                                  | 22.4                              | 7.9                             | 9.8                           | 10.1                         | 12.6                            | 52.1                    | 32.1                  |
| France                         | 67                         | 13.4                                | 19.8                              | 5.8                             | 8.9                           | 7.6                          | 11.7                            | 59.2                    | 30.2                  |
| UK                             | 65                         | 11.8                                | 18.2                              | 5.3                             | 8.2                           | 6.5                          | 10                              | 55.5                    | 28.2                  |
| Turkey                         | 81.3                       | 6.3                                 | 7.8                               | 2.8                             | 3.4                           | 3.5                          | 4.4                             | 50.1                    | 11.7                  |
| Australia                      | 23.5                       | 3.9                                 | 16.4                              | 1.8                             | 7.6                           | 2.1                          | 8.8                             | 51.1                    | 22.6                  |
| Canada                         | 35.9                       | 6.9                                 | 19.1                              | 3.1                             | 8.6                           | 3.8                          | 10.5                            | 47.3                    | 23.8                  |
| New Zealand                    | 4.5                        | 0.71                                | 15.6                              | 0.33                            | 7.3                           | 0.38                         | 8.4                             | 52.9                    | 22.4                  |

(Table constructed from population data of the countries selected from CIA WorldFact Book)

population of 203 million, the surviving aged population would be 6 million in total where the aged men and women share the population by tying with 3 million each. This is actually preposterous and the solution lies with the government coming to the realization of their expected intervention as also recommended by the CIA's contextual definition of a reduced aged population and in appropriating the effect of high or low elderly populace, and total dependency ratio. Sequel to the obtainable dependency ratios, the government must implement a viable welfare cum benefit program, institute adequate health infrastructural facilities and amenities to reduce high mortality or death rate thereby increasing the survival rate of the teeming youth population to survive the menace of short life span prevalent in the polity. Therefore, the conclusion is that Nigerian government has to consider its total dependency ratio and not the elderly dependency ratio in order to have the promptness to institute welfare and benefits for the aged because the elderly dependency ratio does not reflect this need due to inappropriately cum extremely low aged population.

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## ARTICLE

# Understanding of an ‘Enlightened Planning’ Approach in Project Risk Management

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### ABSTRACT

This article explains the execution and delivery progression phases of the project lifecycle. It is the third phase of the project lifecycle that leads to the final realization of the project's goals. However, this essay will describe the understanding of the ‘enlightened planning’ approach during the execution and delivery strategy progress of a project's lifecycle. The features and details in the *Enlightened Planning* and *PMI PMBOK Guide* are compared. The author explored the nature and role of basic frameworks such as the project lifecycle, the process phase structure, and key project definition questions — the seven Ws (Who, Why, What, Which way, Wherewithal, When, Where). Combining *Enlightened Planning* and *PMI PMBOK Guide*, the differences between the two approaches are given. In addition, the author elaborated the advantages and disadvantages of the two approaches in current practice.

## 1. Introduction

As we all know, project risk management is a significant part of project management. In a constantly changing environment, there are plenty of risks in any project. Project risk refers to that if uncertain events or conditions occur that will affect at least one project goal (PMI PMBOK Guide, 2008, p. 273) <sup>[1]</sup>. Project risk management focuses on identifying and evaluating project risks and managing their opportunities in order to minimize the impact on the project (DOVAL, 2019) <sup>[2]</sup>. Risk management plays a key role in the project management approach by helping to manage risk (Górecki, 2018; Rekha and Parvathi, 2015) <sup>[3] [4]</sup>. It is clear that no project is risk-free, so project risk management is important for a successful project. It is worth mentioning that there are different uncertainties throughout the whole lifecycle of the project, which

needs to be taken into account from the conceptual stage of the project. Ward and Chapman (2003) showed that uncertainty management was more and more preferred in ‘risk management’ and ‘opportunity management’ <sup>[5]</sup>. Uncertainty management is not only a combination of risk management and opportunity management, but also about identifying and managing many sources of uncertainty for all (Ward and Chapman, 2003) <sup>[5]</sup>. The ‘Enlightened Planning’ approach proposed by Chapman (2019) is how to make decisions in the face of uncertain events, so as to ensure effective planning in an uncertain environment <sup>[6]</sup>. The book started with the theoretical analysis of cases in the life, and combined various relevant concepts and principles as well as operations research to comprehensively discuss the approach of ‘Enlightened Planning’. This article discusses the execution and delivery strategy progressive stage of a project's lifecycle.

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## 2. Enlightened Planning and PMI PMBOK

The 'Enlightened Planning' approach is designed to take into account plenty of different issues while systematically and organizationally considering how to respond to complex decisions. It is a holistic approach that aims to maximize the team's ability to respond quickly and correctly to the plan. Enlightened Planning must involve all stakeholders throughout the project creation lifecycle, starting with the concept of creating the project. The execution and delivery strategy progressive stage of the project are a difficult and uncertain process. Each project is different in complexity and nature. It addresses all relevant uncertainties in a systematic way. The strategy, risk and uncertainty of the project interact with each other and all of them have an impact on the project. This requires systematic adherence to core principles. Due to the interaction of various elements, their impact on the project may be multifaceted, so the uncertainty of the project needs to be considered comprehensively. It is necessary to think systematically within an overall environment. Everything is causally connected and no one is affected solely by an individual. The general idea is that risk is correlated. The enlightened planning used real life examples to show that calculated risks over time are much less than inherent risks. Use systematic quantitative and qualitative research methods to analyse the discussion topic. There is no doubt that systematic quantitative and qualitative analysis has certain limitations for enlightened planning. In contrast to a large part of the project risk management, enlightened planning focuses critically on the uncertain location of the project context. It explores and understands the origins of uncertainty. However, both the PMI PMBOK Guide (2008) and enlightened planning divide the project lifecycle into four phases, both of which involve the field of project risk management. The PMI PMBOK Guide (2008) adopts six steps of planning risk management, identifying risks, carrying out qualitative risk analysis, carrying out quantitative risk analysis, planning risk response and monitoring risks (PMI PMBOK Guide, 2008) <sup>[1]</sup>. In addition, the definition of risk includes two types, which are positive risk and negative risk. That is to say, events and opportunities that can have a positive impact on the project are also called risks. An integrated approach to the uncertainty of enlightened planning projects is equivalent to modifying and enhancing the current project risk management process (Ward and Chapman, 2003) <sup>[5]</sup>. Compared with PMI PMBOK Guide (2008), the 'Enlightened Planning' is not only more complete but also comprehensive and detailed <sup>[1]</sup>. The members who use the 'Enlightened Planning' approach for the first time in the project need to analyse the

uncertainty in a more detailed way than those with rich experience, because lack of experience will prevent them from deciding which one is effective.

## 3. Project Lifecycle

The project lifecycle can provide a basic framework for project management. In general, the project lifecycle is divided into four universal processes. In addition to the execution and delivery strategy progress stage, the use of an enlightened planning approach to risk management in the other three project lifecycle stages combined with corporate and operational management needs to be modified accordingly. Each project is unique. There is no denying that even if these projects are separate individuals, which they have something in common. Project members can refer to the previous experience database when identifying risks, but still need to consider the uniqueness of each project. Project members seek similarities on the basis of differences, and then make different judgments according to the actual situation. A common process can be used to develop an appropriate framework for corporate strategic planning that integrates project planning, operational planning, and corporate planning. The latter two stages need to continue to think about what uncertainties still exist in the previously completed phases for project management purposes. The reason is that project data need to be collected and analysed regularly throughout the project lifecycle.

## 4. The Key Features of Enlightened Planning

The key features of enlightened planning include four Fs (Frameworks): a project lifecycle framework, a seven Ws framework, a goals-plans relationships framework and a process framework. In addition, relevant overall characteristics include risk efficiency, clarity efficiency and opportunity efficiency. The seven Ws need to be clearly recognized and properly managed because it is a key aspect of any project. As the focus of work changes as the project progresses, the seven Ws help staff and other stakeholders to integrate, which is critical at every stage of the project lifecycle. Then, the seven Ws in the initial conceptual strategy phase only need a simple plan structure, and the open plan can be discussed in conjunction with the WSL example. The enlightened planning is primarily concerned with the uncertainty of the project. The uncertainty can be divided into the following five key portrayals, which are event uncertainty, inherent variability uncertainty, systemic uncertainty, ambiguity uncertainty and capability-culture uncertainty. It is worth mentioning that the sensitivity graph is a way to combine several lower level of uncertainty sources and then identify the higher

level of uncertainty sources. Decision diagrams are also one of the widely used tool components of enlightened planning. Each project needs to establish a clear and unambiguous goals-plans relationships framework based on the project lifecycle and the seven Ws frameworks. The purpose of this is to clarify the relationship between the company's pursuit of a broader range of objectives at the strategic level and the project plan. It is important to note that variability is not a risk, the two cannot be equated, for instance, when variability is high the risk may be low. Furthermore, communication plays an important role in project planning, and efficient communication is also an important aspect of enlightened planning.

## 5. The Universal Process Concept

The universal process (UP) concept is the basis for the specific process for projects (SPP) phase concept. The four identical key common tasks in all phases are to document, verify, assess and report. The next step in the UP shape phase is the 'identify' phase of the basic SPP. There is no equivalent to the basic SPP phase other than the build to identify phase. There are about three risks identified characteristics of the project. The first is the universality. The people involved in the project are involved in the risk identify phase and the professional involvement is very extensive. The second is that risk identify exists in all phases of the project lifecycle. Thirdly, information collection needs to be comprehensive, timely and accurate. The methods in PMI PMBOK Guide (2008) that theoretically help to discover risk information can be used as tools for risk identification<sup>[1]</sup>. Among them, the most commonly used tools are expert judgment, data collection, data analysis, interpersonal and team skills, prompt lists and meetings. It is important to learn from experience, to save time and resources, and to fill gaps. All members of the project need to work together to maintain tactical clarity within their responsibilities and to reduce the occurrence of unexpected uncertainties. Project members need to pay attention to these points when making plans. The whole risk identification process should also be dynamic. The identify phase refers to the identification of all relevant sources, responses, and conditions. Chapman (2019) explained and highlighted the conceptual differences between the source list and the common practice risk list in the enlightened plan<sup>[6]</sup>. The concept of the source is the source of uncertainty, which generalizes the concept of risk in traditional project risk management. The task starts with the seven Ws that define the problem for the key project, focusing on the important sources. It is the core issue at this stage.

## 6. Risk Identify

The risk identify phase occupies an important position in the entire project risk management process, and it is indispensable for uncertainty management. The reason is that only can we further correctly analyse the risk with a correct understanding of the risk, and finally can we reasonably deal with and control the impact of the risk. However, the risk of the project is mostly potential, and the risk may appear at any time with the development of the project lifecycle. This phase requires an enlightened planning perspective to understand the issues associated with modelling. A clear understanding of clear efficient uncertainty decomposition is an important part of this stage. The competence in enlightened planning approach means that all parameter estimates in the plan must meet or exceed the minimum acceptable clarity level. Probability impact grids (PIG) as an inefficient tool for clarity. All proven probabilities should be objectively analysed with the goal of providing a reference for final decisions when using enlightened planning. It is widely used in many operational and enterprise management environments. The uncertainties of risks all have different probabilities, that is to say, the probability of the occurrence of uncertain events is different. PIG is mentioned in the PMI PMBOK Guide (2008) and APM (1997)<sup>[1] [7]</sup>. In PMI PMBOK Guide (2008), the PIG is used for qualitative analysis rather than quantitative analysis. However, from the perspective of the enlightened planning, the PIG is not a qualitative analysis method<sup>[1]</sup>. It is a method for quantitative analysis after a prepared qualitative analysis section. Importantly, the PIG ignores four of the five related uncertainties. One of the important roles of enlightened planning is to use it to explain clear and inefficient practice tools that are often used. Therefore, discard these tools when making decisions on uncertainty management using enlightened planning. The capability-culture concept has changed the basic level framework assumptions. The capability-culture concept is an integral part of the basic level, and suitable members are its key components. The fundamental characteristics of the enlightened planning drive these differences because any contributing discipline lacks exclusive ownership or parental rights to the concept of the enlightened planning approach.

## 7. The Basic SPP 'Ownership' Phase

Another phase of the 'Enlightened Planning' approach is the basic SPP 'ownership' phase. It is another way of saying something about UP shape phase and UP test phase. All aspects of this phase need to be looked at this

phase, and all related ideas need to be rigorously tested, because there are some aspects that are not obvious. The less obvious aspects can be very risky so every aspect has to be considered. In addition, the SPP basic ownership phase is reflected in the PUMP ownership phase. The nature of this phase depends on where the project lifecycle has reached. This phase focuses on ownership, contracts and other related issues. An issue of concern is to clarify the terms and ownership of the company in relation to desired goals, balanced goals, and committed goals. *Enlightened planning* discusses in chapter seven the effective basis for a very simple project duration-cost tradeoff model that can be compared with the economic order quantity model in chapter five in the book. The 'models of some key issues' in Chapter Five addresses the shape of the planning phase of the planning. The 'Enlightened Planning' approach to clarify ambiguous times means additional costs and time. A central aspect of the enlightened planning approach is the emphasis on building and maintaining trust, but this is generally a complex issue. The reason is that the related opportunities and risks differ in nature and are difficult to deal with in some cases. This ownership phase plays an important role in promoting careful contextual attention to these issues. This phase is crucial in the whole process. The final step in the ownership phase of the particular task is whether or not to enter the quantitative phase, which it as a link before and after. I think this phase is very important so I chose this phase.

## 8. Project Risk Management Process

The project risk management process that is now frequently used does not have a similar component and is not used as a project planning phase, including the process that is used by the Water and Sewage Limited (WSL). The core issues of modeling are most often viewed as specific decisions when making plans using any variation of the UP concept. Gantt charts can be used to describe project plans, making the content clearer in the form of charts. Understand the specific sources of underlying uncertainty. Building from the bottom up requires selectively moving the bottom down and then selectively displaying it from the top down. Bottom-up planning means starting from a fairly low level, which is a key aspect of strategic clarity. This is an easy way to capture concerns that may be completely ignored or not effectively addressed. This is an important opportunity and is part of the overall opportunistic efficiency of the approach. The analytical portion of the process initially focuses on a lower level, followed by a tentative upward movement that is a significant possibility. Top-down planning is about getting as close to the top as you can, mainly working down. In PMI PMBOK Guide

(2008), project risk management is roughly divided into the following seven processes, which are planning risk management, identifying risks, carrying out qualitative risk analysis, carrying out quantitative risk analysis, planning risk response, carrying out risk response and monitoring risks<sup>[1]</sup>. Some of these processes are different from the enlightened planning approach, and their theoretical core is different. In general, the enlightened planning approach is more rigorous than traditional risk management approach.

## 9. Conclusions

The 'Enlightened Planning' approach has been used since the concept strategy formation phase. The application of the enlightened planning approach must satisfy a number of strict conditions that are necessary for effective management, which is one of the prerequisites for its use. Project risk management is one of the basic activities of project management. Different risks may arise at each stage of the project. The person must make own judgment and take action according to own situation. The enlightened planning approach is based not only on project management and project risk management, but also on project planning. The important thing in this field is to think about what risk and uncertainty really are, and to look at the richness of concepts and cases in a new way. The core idea of the enlightened planning approach is wholeness. Approval of the strategic plan is required prior to the execution and delivery strategy progress stage. From the enlightened planning approach perspective, everyone on the project needs to have an overall understanding of the following issues. One is the toolset and skills and definitions of 'risk', 'opportunity', 'uncertainty' and 'complexity'. People should not confuse some of the concepts and nature. However, even the same uncertain events are different in different domains. The other is the precision of the terminology. The terminology in the project should be consistent and accurate. There are lots of points that the enlightened planning approach needs to consider comprehensively. Project risk management has attracted more and more attention in recent years. Uncertainty management is very important for the success of projects. Those involved should do their best to understand the set of procedures and details of the enlightened planning approach.

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**ARTICLE**

# **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**

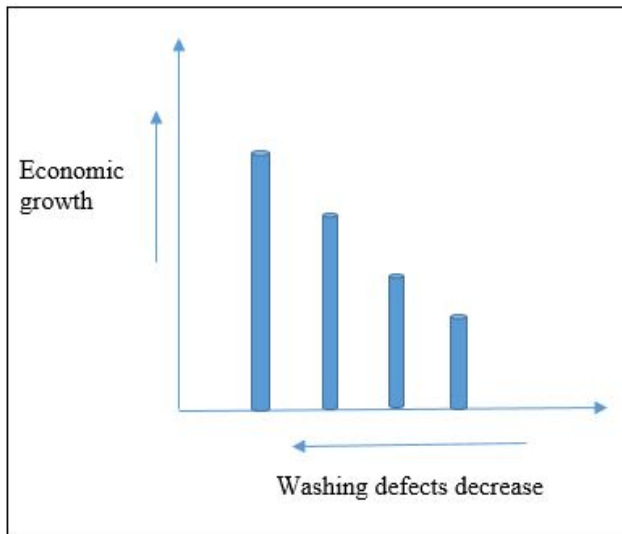
The textile and garment has a significant role in economic development in Bangladesh by exporting these products [6]. Bangladesh gross domestic product (GDP) increased from \$6.29 billion to \$286 billion from 1972 - 2019, where \$41 billion was generated by exporting, and surprisingly around 84% comes 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.

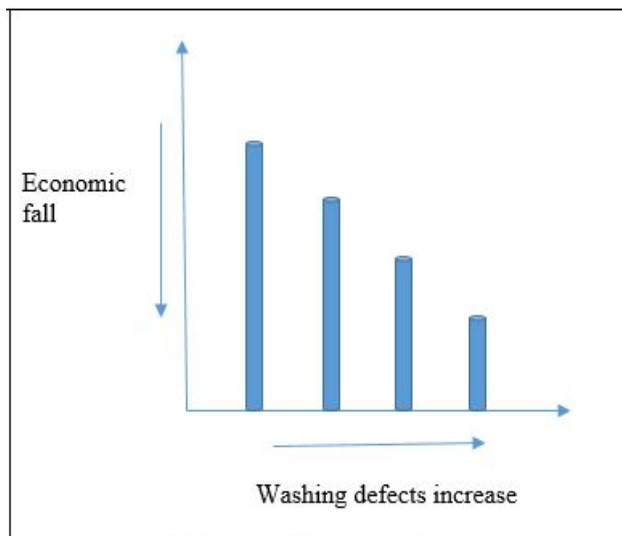
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**Figure 1.** When washing defects decrease



**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<sup>[3]</sup>. 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<sup>[5]</sup>. 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 <sup>[5]</sup>. 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<sup>[5]</sup>. 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:

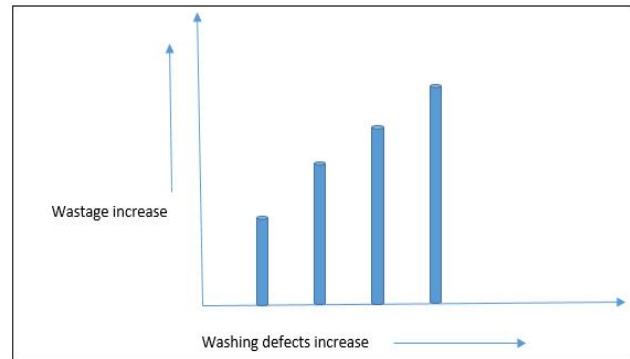


Figure 3. Washing Defects Versus Wastage

### 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:

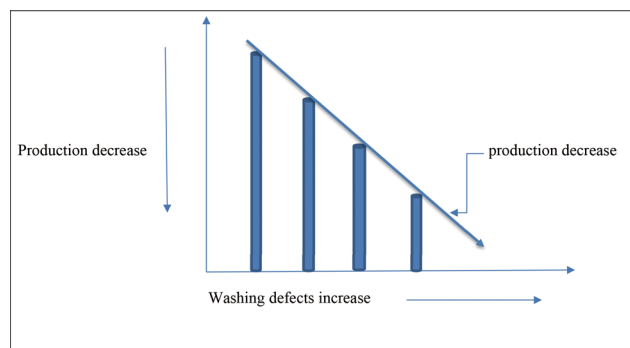
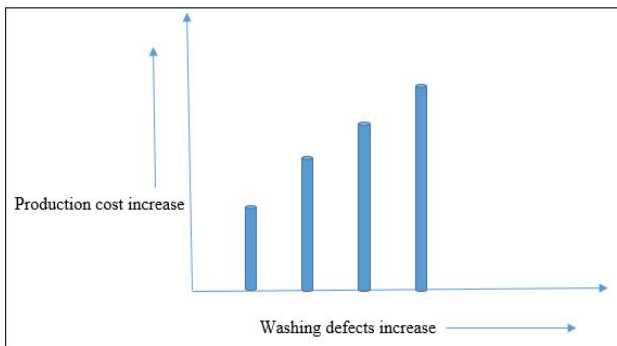


Figure 4. Washing Defects Versus Production

### 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<sup>[1]</sup>. 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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