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"An Overview of Implementing QR Code on a woven trouser in Garments Industries"

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Abstract

It is commendable that this study focuses on implementing QR code technology in the RMG industry to reduce costs, save time, and promote sustainability. The use of QR codes is a practical solution that can improve efficiency and provide consumers with relevant information about the products they are buying. Moreover, the study highlights the importance of reducing the use of polyester fabric in garment labels, which is a significant step towards promoting environmental sustainability. The adoption of alternative materials and the reduction of waste can have a positive impact on the environment and make the industry more attractive to eco-conscious consumers. The report's potential impact on the RMG industry is noteworthy, as it can provide valuable insights for businesses looking to adopt more sustainable practices and attract environmentally conscious buyers. The use of natural resources can also be optimized, and the industry can benefit from cost savings, better resource management, and increased competitiveness in the global market.

In summary, the study's focus on QR code implementation, the reduction of polyester fabric use, and the adoption of sustainable practices in the RMG industry is commendable. Its findings can have a positive impact on the environment, businesses, and consumers, and shed light on important issues related to the industry's sustainability.

Keywords: Quick response; Universal product code; Uniform resource identifier; Uniform resource location; Wireless fidelity; International organization for standardization; Japanese Institute of standards; Bose Cahudhuri hocquerghem; Extended channel interpretation; Function code one; Secure quick response code; Just another bar code; General public license; Service set identifier; Phase shift keying; Wi-Fi protected access, Wired equivalent privacy; Readymade garments etc.

CHAPTER-1

1. Introduction.

QR codes were first developed by a Japanese company called Denso Wave in 1994 for use in the automotive industry. They were designed to enable fast decoding and were originally used to track vehicles and parts during the manufacturing process. Since then, QR codes have become widely popular for a variety of uses due to their ability to store large amounts of information and be easily scanned by mobile devices. They are now used in advertising, ticketing, payment systems, product information, and many other applications.

QR codes have become increasingly popular in recent years due to their ability to store large amounts of information in a small space, and the ease with which they can be scanned by smartphones and other devices. They are often used for a variety of purposes, including product information, marketing, and payment transactions. The ability to store different types of data, such as URLs, text, and images, has made QR codes a versatile tool for businesses and individuals alike.

Implementing QR codes on ready-made garments can offer several benefits. For example, it can provide consumers with easy access to product information such as fabric content, care instructions, and country of origin. It can also enable brands to track and authenticate their products, helping to prevent counterfeiting and improve supply chain management. QR codes on garments can also be used to enhance the shopping experience for customers. For instance, they can be used to provide personalized recommendations or promotions based on a customer's purchase history. They can also be used to enable mobile payments, making it easier and more convenient for customers to make purchases. Additionally, implementing QR codes on ready-made garments can offer several benefits for both brands and consumers. It can provide greater transparency, convenience, and security in the shopping experience, and help brands to better manage their supply chain and prevent counterfeiting.

CHAPTER-2

2. Review of literature

QR codes have become increasingly popular in inventory management and retail, as they provide a quick and efficient way to store and retrieve information about products. However, QR codes have many other potential applications beyond inventory management. For example, QR codes can be used in marketing and advertising campaigns to provide customers with more information about products and services. They can also be used to provide quick access to websites, social media profiles, and other digital content. In addition, QR codes can be used in event management to provide attendees with digital tickets, schedules, and other information. QR codes can also be used in education to provide students with access to digital resources such as textbooks, videos, and interactive activities. They can be used in healthcare to provide patients with access to their medical records and other important information. QR codes can also be used in transportation to provide travelers with access to transportation schedules and other information. Overall, the possibilities for using QR codes are vast and varied, and as technology continues to advance, we are likely to see even more innovative applications for this technology in the future.

Actually, in this modern age every production firms want to reduce the wastage to get maximum profit from their existing business. Regarding this concept, QR code is used now everywhere and future leaders are planning that where it can be implemented in the modified way. QR codes are two-dimensional barcodes that can store a significant amount of information in a small space. However, they require a specific reader machine or a smartphone with a QR code scanning application to interpret the information they contain. While QR codes can store a lot of information, it can be difficult for people to access that information if they do not have access to a reader or do not know how to use one. Additionally, QR codes may not be accessible to people with visual impairments or other disabilities that make it difficult to use a smartphone or a QR code reader.

Despite these limitations, QR codes have become increasingly popular in recent years because they can provide a quick and easy way to access information or to complete a transaction. Many businesses and organizations use QR codes to provide customers with access to product information, coupons, and other promotions, and QR codes are also used for mobile payments, event registration, and other applications. QR codes offer numerous benefits for both daily and industrial life, making them a popular and versatile technology. Quick and Convenient: QR codes offer a fast and convenient way to access information or complete a transaction. All you need is a smartphone with a QR code reader app to scan the code, and you can instantly access the information or complete the transaction, like as:

1) **Cost-Effective:** QR codes are a cost-effective way to store and distribute information. They can be printed on a variety of materials, such as paper, plastic, or metal, and can be produced in large quantities at a low cost.
2) **Versatile:** QR codes can be used for a wide range of applications, including marketing, payment processing, inventory management, and authentication. They can store a variety of information, including URLs, text, and contact information.
3) **Traceable:** QR codes can be designed to track user engagement, providing valuable data for marketing and analysis purposes.
4) **Enhanced Security:** QR codes can be designed with encryption and authentication features to enhance security and prevent fraud.
5) **Improved Efficiency:** In industrial settings, QR codes can be used to streamline processes and improve efficiency. For example, they can be used to track inventory, monitor production

processes, and provide real-time updates to employees.

2.1 Description of theory/mode

A QR codes will be printed on the care label / on the surface of the garments. In the QR-code the general information likewise how to wash, how to dry, how to rinse, how to ironing, which brand origin it is, what type of fabric are used to make it, what is the style name of that specific finished goods, which season it is made for, what type of raw-materials are used to make it- all necessary information has to be shown for the end users without having any permission by scanning it. These information is presented to the consumer in various language as the goods are shipped to different countries. On the other hand, some internal information will be preserved in a website for security purpose and that web-links/ virtual address/ cloud files link will be added in the QR-code. These web-links are existed here for internal use and that can be accessed by password where the internal employee & our valuable buyer can get the information about total detailing of a garments and all the legal documents regarding order packages.

Finally, the method of QR codes on care labels can be a convenient and efficient way for consumers to access important information about their garments. By scanning the QR code, consumers can easily access information to care the garments properly. Including multiple languages in the QR code is also a great idea as it ensures that consumers from different regions and countries can access the information. Additionally, linking internal information on a separate website can help ensure that sensitive information is not easily accessible to the public. Moreover, we can reduce the uses of non-eco-friendly polyester materials in garments industry.

2.2 The Main strength of that model.

1) To reduce the cost of making for care label.
2) The main strength of using QR codes as care labels in the apparel industry is that they provide a more efficient and accurate way of communicating care instructions to consumers. QR codes can store a large amount of information in a small space, and consumers can scan the code with their smartphone to access the care instructions. This eliminates the need for consumers

to search for and read through a lengthy care label, which can be especially useful for international customers who may not understand the language printed on the label.

3) QR codes also enable brands to provide more detailed and specific care instructions, including information on how to care for specific fabrics and materials, as well as instructions for different types of washing and drying methods. This can help to prolong the life of the garment and prevent damage, which ultimately benefits both the consumer and the brand.
4) In addition, using QR codes as care labels can also help to reduce waste and environmental impact by eliminating the need for physical labels that can contribute to textile waste. This aligns with the growing trend of sustainability and environmental consciousness in the fashion industry.
5) Using QR codes as care labels in the apparel industry can improve the consumer experience, provide more accurate and detailed care instructions, and promote sustainability and environmental responsibility.
6) Internal employee of the production plant and buyer will not be faced any difficulties to get any information for a specific style. Although it is 12years older style, it will not be tough to get the proper information as it served safely in the website link which can be easily accessed by the QR-code.
7) Help us to retain new and existing buyers for our new inventions and facilities.

2.3 Main weakness of that model.

1) **Require Awareness:** Need more time to habituate the consumer to know about the QR-code method. Must be taken some promotional activities/offers to habituate the consumer earlier.
2) **Limited accessibility:** Not all consumers have smartphones or the ability to scan QR codes, which means that they may not be able to access the information provided.
3) **Reliance on technology:** The use of QR codes relies on the technology being functional and available. If there are issues with the code or the scanning device, consumers may not be able to access the information they need.
4) **Language barriers:** QR codes may be difficult to use for consumers who speak a different language or who have limited literacy skills. The information provided may not be translated, or the consumer may struggle to understand the instructions provided.
5) **Lack of standardization:** There is no universal standard for QR codes, which means that different companies may use different codes or formats. This could create confusion for consumers and make it difficult for them to access the information they need.
6) **Potential for error:** If the QR code is not printed correctly, it may not work or may provide inaccurate information. This could lead to consumer frustration or confusion and could impact their satisfaction with the product.

2.4 Opportunities of that model.

QR codes can provide a range of opportunities for the apparel industry when used as care labels. Here are some potential benefits:

1) **Improved customer experience:** QR codes allow customers to easily access care information for their garments. Instead of having to search through printed labels or tags, they can quickly scan the code with their smartphone to access the information they need.
2) **More detailed care instructions:** QR codes can provide more detailed care instructions than traditional printed labels. Manufacturers can include videos or step-by-step guides that show customers exactly how to care for their garments, reducing the risk of damage and extending the life of the garment.

3) **Reduced environmental impact:** QR codes can eliminate the need for printed care labels, which can reduce the environmental impact of the apparel industry. This can be particularly important for companies that are committed to sustainability.
4) **Branding and marketing opportunities:** QR codes can be used to promote a brand or specific product features. For example, a company could include a QR code on a garment that links to a video showcasing the garment's unique design features or manufacturing process.
5) **Tracking and inventory management:** QR codes can be used to track inventory and manage the supply chain. By including unique codes on each garment, manufacturers can easily track shipments and manage inventory levels.

QR codes can provide a range of benefits for the apparel industry when used as care labels. By improving the customer experience, providing more detailed care instructions, reducing environmental impact, and offering branding and marketing opportunities, QR codes can help companies differentiate themselves and improve their bottom line.

2.5 Threats of that model.

QR codes have become a popular tool for companies to provide information to their customers quickly and easily. However, there are several potential threats associated with using QR codes as care labels in the apparel industry. Some of these threats include:

1) **Technical issues:** QR codes may not work properly if they are not printed clearly or if the scanner is not able to read them properly. This can result in frustration for customers who are trying to access important care information.
2) **Security risks:** QR codes can be easily copied, which means that a malicious actor could potentially create fake codes and distribute them to customers. This could lead to customers receiving incorrect care information or even being directed to phishing websites.
3) **Limited accessibility:** Not all customers may have access to a smartphone or a device that can scan QR codes. This could make it difficult for some customers to access care information, which could result in them improperly caring for their clothes and damaging them.
4) **Language barriers:** QR codes typically provide information in a digital format, which means that it may be difficult to provide care instructions in multiple languages. This could make it difficult for non-native speakers to understand how to properly care for their clothes.
5) **Environmental concerns:** QR codes are typically printed on paper, which could contribute to environmental issues if not disposed of properly. Additionally, if customers are required to print out the QR code, this could result in further environmental waste.

While QR codes may seem like a convenient option for providing care information in the apparel industry, there are several potential threats associated with their use. Companies should carefully consider these threats before deciding to implement QR codes as care labels.

CHAPTER-3

3. Methodology.

Both QR Code and Bar code are machine-readable codes that consist of a pattern of parallel lines of varying widths and numbers, which can be read by a barcode scanner or a mobile device with a camera. These codes are used for various applications, including stock control, inventory management, tracking, and identification.

The primary difference between QR Code and Bar code is their capacity to store information. QR Code has a much higher storage capacity than the Bar code, which means it can store more data. QR Code can store up to several hundred times more data than Bar code, making it suitable for applications where a large amount of information needs to be stored in a small space.

Another difference between QR Code and Bar code is the way they are read. Bar codes are read using a laser scanner, which reads the pattern of lines and converts them into a series of numbers. QR Codes, on the other hand, can be read using a camera on a mobile device or a barcode scanner, which reads the pattern of lines and converts them into a digital format.

Mainly, both QR Code and Bar code are important tools for businesses and individuals who need to track, manage and identify products. However, QR Code has more advantages over Bar code in terms of storage capacity, versatility and ease of use, making it a more popular choice for modern applications.

3.1 Types of Bar Code.

Numeric Only Barcode	Alpha-Numeric Only Barcode	Two-Dimensional Barcode
UPC codes.	Plessey codes.	QR codes.
EAN codes.	Code 39.	Data Matrix.
Industrial 2 of 5 codes.	LOGMARS.	PDF 417.
Interleaved 2 of 5 codes.	Code 128.	AZ tech.
Standard 2 of 5.	Code 93.	
POSTNET.		
Code 11.		
Coda-bar.		

Table 3.1: Types of Bar Code.

3.2 Created modified QR (C&B QR Code).

As my intention is to carry more information regarding a specific garments in a small place instead of polyester care label which we used on a garment previously to share care instructions & other relevant files with different community, here I would like to introduce the QR code implementation process on garments industry. I rename name this code is as “C&B QR code”. It means “Consumer & Buyer Access Quick Response Code”.

"C&B QR code" consists multi-information for the manufacturers, retailers/buyers and end users/consumers. By scanning "C&B QR code" anyone can get the proper information about the garment without any permission. But the information which are preserved for the manufacturers & retailers/buyers that must be needed authorization code for security purpose. Initially, I'm using a free website to create a QR code that website name is "me-qr.com".

3.3 The C&B QR Code making process.

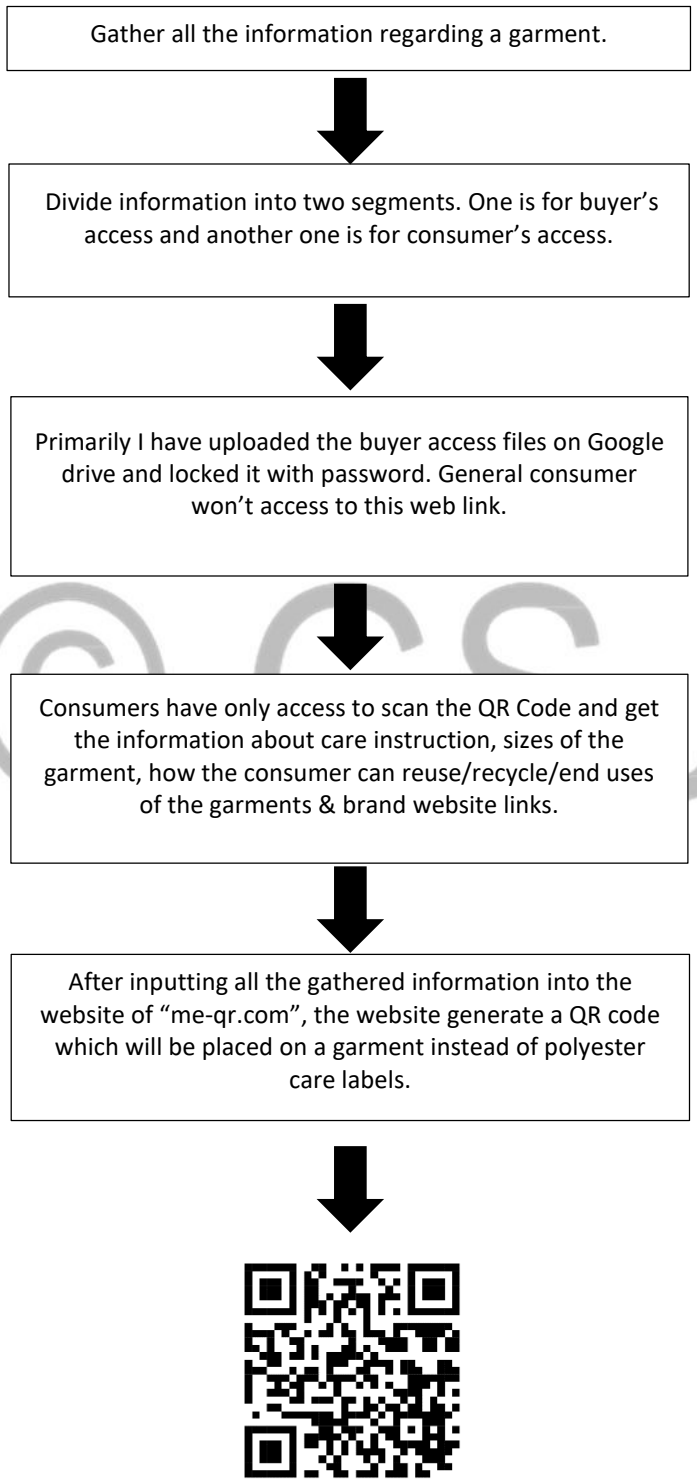


Figure 3.2: The C&B QR Code making process.

3.4 The process of printing C&B QR code.

- As organic pigment printing offers numerous advantages for the garments industry, including durability, eco-friendliness, cost-effectiveness, high-quality prints, and versatility, I have prioritized these process to create a QR Code. Here are some advantages of using organic pigment printing in the garments industry:

  1) **Durability:** Organic pigments have excellent light and wash-fastness, meaning that the colors will remain vibrant and intact even after multiple washes and exposure to sunlight. This makes organic pigment printing ideal for use on garments that will be subjected to regular wear and tear.
  2) **Eco-friendly:** Organic pigments are made from natural sources, such as plants and minerals, and are free from harmful chemicals like heavy metals and solvents. This makes organic pigment printing a sustainable and eco-friendly alternative to traditional printing methods that use synthetic dyes.
  3) **Cost-effective:** Organic pigment printing is a cost-effective printing method, as it requires fewer resources and chemicals than other printing methods. Additionally, the durability of organic pigments means that the prints last longer, reducing the need for frequent reprints.
  4) **High-quality prints:** Organic pigment printing produces high-quality prints with sharp and vibrant colors. This makes it an ideal choice for printing intricate designs and patterns on garments.
  5) **Versatility:** Organic pigment printing can be used on a variety of fabrics, including cotton, polyester, and silk. This makes it a versatile printing method that can be used for a range of garments, from t-shirts and sweatshirts to dresses and skirts.

- The basic steps involved in the process are provided at below:

  1) **Design creation:** The first step is to create the design that will be printed on the t-shirt. This can be done using graphic design software like Adobe Illustrator or Photoshop.
     Here I'm selecting the QR code as design which is created/generated with the help of "me-qr.com"

  2) **Color separation:** Once the design is created, it needs to be separated into individual colors. Each color will require a separate screen to be created.
     I need only one screen as I have chosen only black color to create QR code design layout.

  3) **Screen preparation:** A screen is coated with a light-sensitive emulsion and allowed to dry. A positive of each color separation is then placed on the screen and exposed to UV light. The emulsion hardens where the light hits it, creating a stencil for the ink to pass through.
  4) **Ink mixing:** The black ink & fixing agent is mixed to proceed organic pigments. These pigments are made from natural materials and are non-toxic.
  5) **Printing:** The t-shirt is placed on the printing press, and the screen is positioned on top. Ink is poured onto the screen, and a squeegee is used to push the ink through the stencil and onto the t-shirt. This process is repeated for each color in the design.
  6) **Drying and curing:** Once QR code as a design is printed, the ink needs to be dried and cured to ensure it is permanent. This can be done using a heat press or by leaving the t-shirt to air dry for several days.

Used Polyester Care Label

Implement printed "C&B QR Code" instead of polyester care

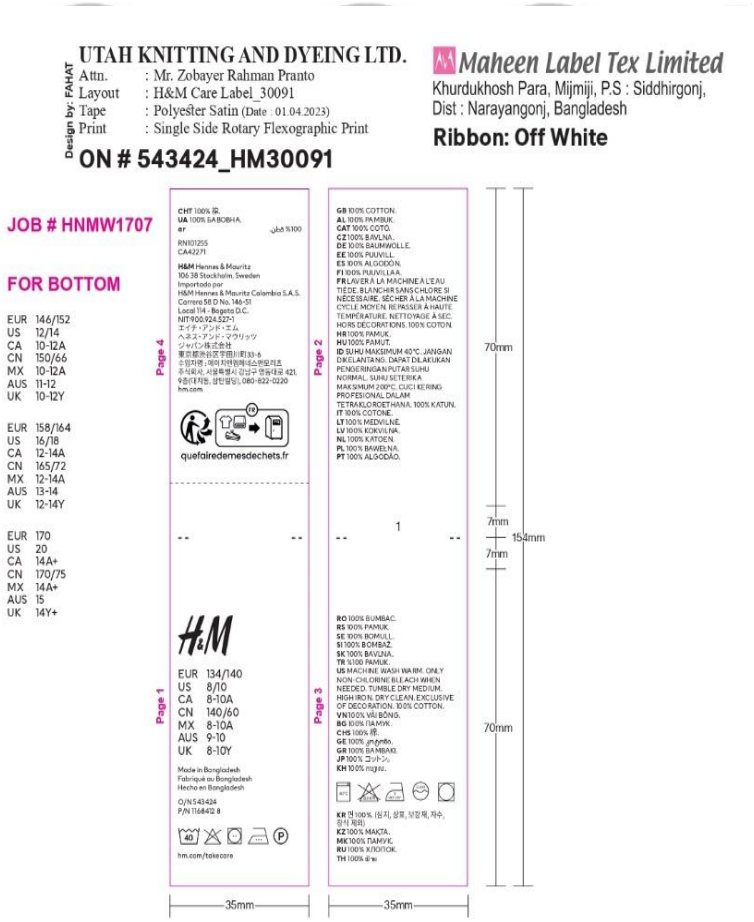
Figure 3.3: Implementing C&B QR code on a woven trouser

7) **<u>Finishing & Placement:</u>** Finally, any excess ink is removed from the screen, and the screens are cleaned and stored for future use.

4. Results & Discussion.

After completing all the process, I have got a "C&B QR code" which providing customers with information about the products details and how to dispose of them responsibly is a great way for the garment industry to reduce waste and promote sustainability. Although, I have chosen homemade screen-printing process for implementing C&B QR code on garments surface initially, but in terms of bulk production this method can be slightly changed. In that case printing process can be done into two ways- 1) Pigment Screen Printing. 2) Flexographic printing. By this two-printing process the cost of printing & time of placing print will be reduced that will help me to increase the productivity. Further, Customer can easily get the product information within a minute by scanning the "C&B QR code" through smart phone whereas buyer/internal employee needs the counter sample to get QR Code and security codes to access confidential web files to get all the information regarding the product. The garment factories under BGMEA, BKMEA & international brands will improve in future, if this method will be implemented properly in the garments factories in the same manner. I believe that, the rate of placing order will be increased for that innovative initiative and buyer will not try to shift their business to the other production unit.

As per below polyester care label layouts, a garment contains main label, size label, care label, fabric composition label, brand name etc. The length of the polyester care label is 154MM/ 0.168416 Yards and width is 35MM/ 0.0382765 Yards, so the area is (154*35) = 5,390 square millimeters and assume that a garment contains 2 pages of polyester labels, then (5390*2) = 10,780 square millimeters or 11.789151 yds. But according to our study I can reduce almost all the polyester fabric. Here I will use only C&B QR code by piment screen / flexographic printing.



SL. No.	Description	Values
1	Length of polyester Care label	154MM
2	Width of polyester Care label	35MM
3	Area of polyester Care label	(154*35) = 5,390 square millimeters
4	Consumption for per dozen t-shirts (need 2 pages of polyester care label for each garment)	(2*5390*12)= 1,29,360 square millimeters/ 141.46 Yards
5	As per order sheets I have to booked polyester care label fabrics with printing	(2*5390*42945)= 46,29,47,100 square millimeters/ 506285.10 Yards
6	After using "C&B QR Code", only the main fabric will be used instead of polyester care label	(154*35) = 5,390 square millimeters
7	Saving fabric & use existing fabric to placing "C&B QR Code"	As the existing fabrics are used, assume that full quantity (506285.10 yards) of polyester fabric with printing will be considered as saving fabrics

Table 4.1: Consumption of label.

- Price Comparison between existing polyester fabric care label with printing and "C&B QR Code" to implement it on a woven trouser.

Cost per cm polyester label	Label Cost: [{12 + 5%Wastage *0.01}] USD= 0.126 USD Sewing Cost (Attached Cost): [{12* 0.005}] USD= 0.06 USD Total Cost: 0.126 + 0.06= 0.186 USD	[{42,945 + 5%Wastage *0.0155}] USD= 698.9298 USD	Saving Cost after using this method: (698.9298-360.738)= 338.1918 USD
Cost per cm "C&B QR Code"	Raw-materials & Placement Cost: (12*.008) BDT= 0.096 BDT	[{42,945 + 5%Wastage *0.008}] USD= 360.738 USD	

Table 4.2: Costing Comparison between polyester label and C&B QR Code consisting label.

By using "C&B QR Code" we minimize the garments production cost. This "C&B QR Code" practices will help us to save the earth from non-ecofriendly polyester fabrics and as well as inspire global people to make sustainable goods.

- How our code works:

Smartphones have become an integral part of daily life for many people around the world. Smartphones are also important tools for productivity, with apps like calendars, to-do lists, and note-taking apps helping us stay organized and get things done. Many people now use their smartphones to shop online, with e-commerce apps making it easy to browse and purchase products from anywhere. Scanning a QR code by a smartphone will be one of the achievement for me to generate this idea on the RMG/relevant industries. To scan that "C&B QR code", consumer and internal employees must have a QR code scanner apps in his device.

1. Consumer Access Point:

After scanning the "C&B QR code" by a consumer, consumer will get all the care instruction and other basic information (particle/raw materials are needed to prepare this product, how to use, how to care and after using how can we use it in a proper way either it is in recycling form or re-use form) regarding the specific product in different language. Consumer have no access at the below web link whereas internal employee/ brand management can access to this link for future development.

2. Buyer Access Point:

After scanning the **"C&B QR code"** by buyer/internal employee, can get every information regarding garments of that specific garments (spec. sheet, tech pack, design sheet, purchase order, trims & accessories information, supplier information, costing and consumption, marker consumption, thread consumption etc.).

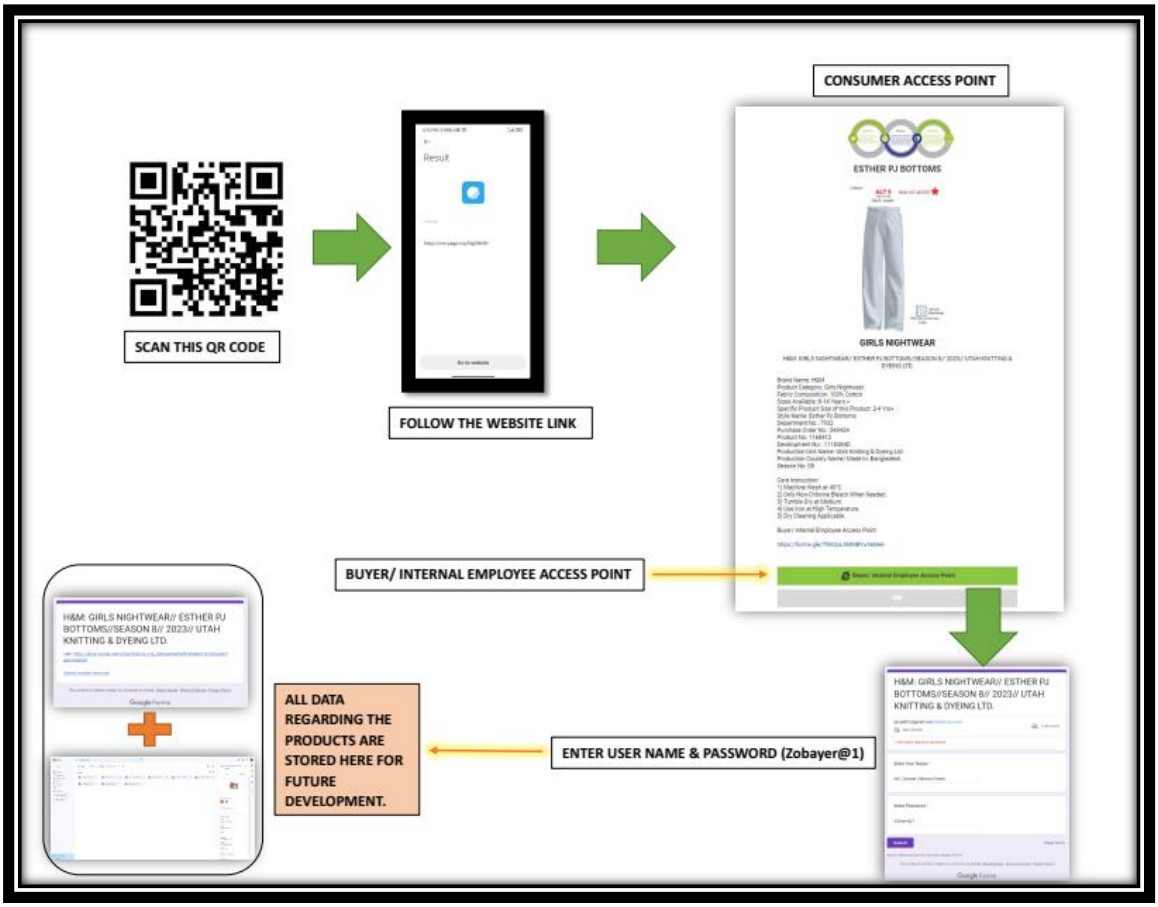


Figure 4.3: How the consumer & buyer/ internal employee access to through C&B QR Code.

5. Conclusion.

A QR Code is a machine-readable optical label that contains information about the item to which it is attached. The specialty of this unique code is to contain a lots of words and information in a specific short place. Implementing that unique code to the RMG industries to preserve all the detailing information of a garment to reduce the cost of label segment. QR codes can be a very efficient way of storing and sharing information in a compact format. By scanning the QR code, consumers can quickly access information about the garment, such as its care instructions, composition, and origin. Moreover, QR codes can be an excellent tool for promoting sustainable practices, such as using natural resources adequately, recycling, and reusing. By including a tagline on the care label that is stored in a QR code, you can easily educate consumers about the environmental impact of their clothing choices. Overall, the implementation of QR codes in the RMG industry is a great step towards improving efficiency and reducing costs while also promoting sustainability. It is an innovative solution that can benefit both the manufacturers and the consumers.