



**APPAREL MADE-UPS HOME FURNISHING
SECTOR SKILL COUNCIL**

Participant Handbook

Sector
Apparel

Sub-Sector
Apparel, Made-Ups & Home Furnishing

Occupation
Quality Assurance

Reference ID: **AMH/Q0104, Version 1.0**
NSQF level: **5**



Apparel Quality Analyst

Published by

Apparel, Made-Ups & Home Furnishing Sector Skill Council

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This book is sponsored by Apparel, Made-Ups & Home Furnishing Sector Skill Council

Printed in India by AMHSSC

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Shri Narendra Modi
Prime Minister of India

“

Skill development of the new generation is a national need and is the foundation of Aatmnirbhar Bharat

”



Certificate

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APPAREL, MADE-UPS & HOME FURNISHING SECTOR SKILL COUNCIL

for

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: 'Apparel Quality Analyst'
QP No. 'AMH/Q0104, NSQF Level 5'

Date of Issuance: February 13th, 2026

Valid up to: February 13th, 2029

* Valid up to the next review date of the Qualification Pack

Authorised Signatory
(Apparel, Made-Ups & Home Furnishing Sector Skill Council)

Acknowledgements

Apparel, Made-Ups & Home Furnishing Sector Skill Council would like to express its gratitude to all the individuals and institutions who contributed in different ways towards the preparation of this “Participant Handbook”. Without their contribution it could not have been completed. Special thanks are extended to those who collaborated in the preparation of its different modules. Sincere appreciation is also extended to all who provided peer review for these modules.

The preparation of this handbook would not have been possible without the Fashion Industry’s support. Industry feedback has been extremely encouraging from inception to conclusion and it is with their input that we have tried to bridge the skill gaps existing today in the industry.

This participant handbook is dedicated to the aspiring youth who desire to achieve special skills which will be a lifelong asset for their future endeavours.

About this book

Welcome to the “Apparel Quality Analyst” training programme. This PHB is designed to provide participants with comprehensive knowledge about the principles and practices of maintaining security, ensuring vigilance, and safeguarding premises. It also focuses on planning, executing, and managing routine security tasks, conducting inspections, and verifying the integrity of individuals and documents as part of field operations.

This Participant Handbook is designed based on the Qualification Pack (QP) under the National Skill Qualification framework (NSQF) and it comprises of the following National Occupational Standards (NOS)/ topics and additional topics.

1. AMH/N0108: Analyze and Classify Garment Defects in Apparel Production
2. AMH/N0109: Analyze Data and Prepare Quality Insights Reports
3. AMH/N0110: Integrate Digital and AI Tools in Quality Assurance Systems
4. AMH/N0111: Utilize AI-Based Analytics for Quality Monitoring
5. AMH/N0112: Apply Quality Control Tools and Techniques
6. AMH/N0113: Document, Report, and Visualize Quality Data
7. AMH/N0620: Promote and sustain safety, health, and security in workplace, while fostering Gender and Persons with Disabilities (PWD) Sensitization
8. AMH/N0621: Adhere to industry, regulatory, and organizational standards and embrace environmentally sustainable practices
9. DGT/VSQ/N0102: Employability Skills (60 Hours)

Symbols Used



Key Learning
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1. Introduction and Orientation to Apparel Quality Analyst



Unit 1.1 - Apparel Quality Analyst Profession Insights



Key Learning Outcomes



By the end of this module, the participants will be able to:

1. Describe the size and scope of the apparel industry and the production processes within it.
2. Discuss the specific roles and responsibilities of an Apparel Quality Analyst in ensuring production standards.
3. Outline the various employment opportunities available for an Apparel Quality Analyst across different industry settings.
4. Elucidate the critical role that an Apparel Quality Analyst plays throughout each stage of the apparel production process.

UNIT 1.1: Apparel Quality Analyst Profession Insights

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the structural size, scope, and production workflows defining the modern apparel industry.
2. Discuss the operational responsibilities and professional duties assigned to an Apparel Quality Analyst.
3. Outline the diverse career pathways and placement settings available to an Apparel Quality Analyst.
4. Elucidate the exact function and impact of an Apparel Quality Analyst during manufacturing stages.

1.1.1 Apparel Industry Size and Scope

The apparel industry includes the design, manufacturing, distribution, marketing, and retail of clothing, covering casual, sportswear, formal, ethnic, and luxury apparel. The global apparel market is projected to reach US\$1.92 trillion in 2026 and US\$2.5 trillion by 2033 at a 4.1% CAGR, while the Indian apparel market is expected to grow from US\$115 billion in 2026 to approximately US\$193 billion by FY2030, driven by rising consumer demand, organised retail, digital commerce, and increasing disposable incomes. (Statista, 2026; Grand View Research, 2026; India Brand Equity Foundation (IBEF), 2026).

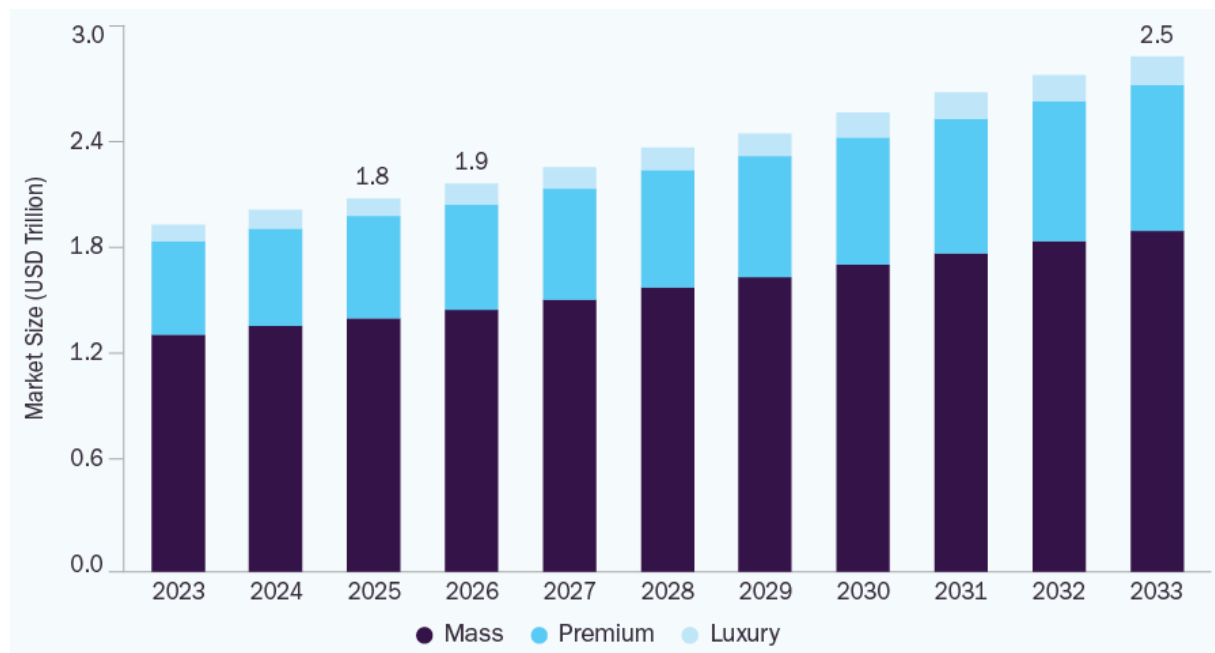


Fig. 1.1.1: Global apparel industry overview

(Source: <https://www.grandviewresearch.com/industry-analysis/apparel-market-report>)

Indian apparel industry

The Indian apparel industry refers to the sector that designs, manufactures, processes, markets, and exports garments and clothing products made from natural and manufactured fibres. It includes activities such as fabric sourcing, garment production, quality inspection, finishing, branding, retail, and export, serving both domestic and international markets. This industry has evolved from a traditional

handloom and handicraft sector into one of the world's largest textile and garment manufacturing industries. Its growth has been influenced by changing consumer preferences, technological advancements, government policies, global trade agreements, and sustainability initiatives.

Progress of the Indian apparel industry

The following account provides a comprehensive overview of the structural evolution of the Indian apparel industry:

- **Ancient and medieval era**

From 2500 BCE to 1757, India became globally renowned for producing fine cotton, silk, muslin, and naturally dyed textiles, while royal patronage promoted handloom weaving, embroidery, and textile trade. Key developments: Indus Valley cotton, Bengal Muslin, Kanchipuram Silk, Banarasi Silk, Kalamkari, Chanderi, Ikat, Ajrakh prints, Mughal brocades, Zardozi embroidery, Jamdani weaving, Kashmiri Pashmina, and Paithani sarees.



Fig. 1.1.2: Traditional Indian handloom textiles

- **Colonial era**

Between 1757 and 1947, the first cotton textile mill (1854) introduced mechanised production and revived indigenous textiles, making Khadi a symbol of India's freedom movement. Key developments: cotton mills in Mumbai and Ahmedabad, Khadi, Charkha spinning, and Khadi and Village Industries.



Fig. 1.2.3: Khadi and charkha-based textiles

- **Industrialisation and the export era**

From 1947 to 1990, post-Independence policies expanded textile manufacturing, strengthened cooperative weaving, and promoted apparel exports through the establishment of the Apparel Export Promotion Council (1974). Key developments: Bombay Dyeing, Arvind Mills, Raymond, National Textile Corporation, Gokaldas Exports, Orient Craft, Shahi Exports, and Pearl Global Industries.



Fig. 1.1.4: Early Indian garment factory

- **Globalisation and the modernisation era**

Since 1991, economic liberalisation has accelerated investment, technology adoption, and export growth, establishing India as a major global apparel manufacturing hub. Key developments: Levi's, Benetton, Marks & Spencer sourcing from India, and the expansion of garment clusters in Tiruppur, Bengaluru, and Noida.



Fig. 1.1.5: Modern apparel manufacturing unit

Current market position of the Indian apparel industry

Current market position of the Indian apparel industry refers to the industry's present size, economic contribution, global competitiveness, export performance, growth potential, and standing in domestic and international apparel markets.

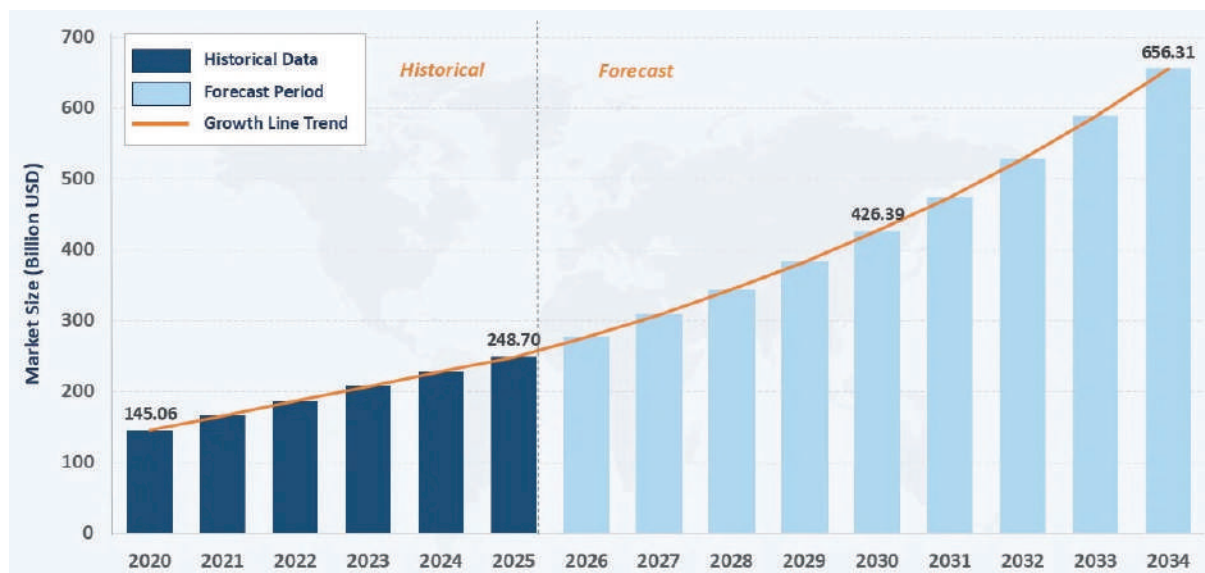


Fig. 1.1.6: Indian apparel market

(Source: <https://www.imarcgroup.com/ckeditor/f3e5569b-ed6c-466c-9ba4-0bc85f86c3d8slide1.webp>)

The following points showcase the major milestones and unique capabilities of the Indian apparel industry:

- The Indian apparel and textile industry is valued at approximately US\$179 billion (US\$142 billion domestic market and US\$37 billion exports), making it one of the world's largest textile and apparel sectors, while the global apparel market is valued at around US\$1.7 trillion, highlighting India's significant growth potential. (Ministry of Textiles, Government of India, 2025).
- According to the Ministry of Textiles, Government of India, India is the 6th largest exporter of textiles and apparel, accounting for 3.9% of global textile and apparel trade. At the same time, Statista, based on World Trade Organisation (WTO) data, ranked India among the top six global clothing exporters in 2024, with clothing exports valued at approximately US\$17 billion.
- In 2005, the World Trade Organisation (WTO) ended the Multi-Fibre Arrangement (MFA) quota system, creating new export opportunities and encouraging the expansion of integrated apparel manufacturing clusters such as Tiruppur, Noida, Bengaluru, Ludhiana, and Surat. (World Trade Organisation, 2005; Ministry of Textiles, Government of India, 2024).
- Between 2005 and 2015, organised retail, shopping malls, e-commerce, and Indian fashion brands accelerated domestic apparel consumption. Brands and platforms such as Pantaloons, Westside, Reliance Trends, Lifestyle, Max Fashion, FabIndia, Biba, Manyavar, Myntra, Flipkart, and Amazon India transformed the retail landscape. (IBEF, 2025).
- The Government of India further strengthened the sector by introducing the Special Package for Employment and Export Promotion in the Apparel Sector (2016), implementing the Goods and Services Tax (GST) in 2017, launching the Production Linked Incentive (PLI) Scheme for Textiles in 2021, and establishing PM MITRA Parks to develop integrated textile manufacturing ecosystems. (Ministry of Textiles, Government of India, 2016; Ministry of Finance, 2017; Ministry of Textiles, Government of India, 2021, 2023).

- Since 2015, the industry has increasingly adopted Industry 4.0 technologies, including CAD/CAM, AI-based quality inspection, robotics, ERP systems, RFID tracking, digital pattern making, and automated cutting machines, improving productivity, quality, and traceability. (Ministry of Textiles, Government of India, 2024; IBEF, 2025).
- From 2020 onwards, apparel manufacturers have increasingly adopted sustainable and circular manufacturing practices, including organic cotton, recycled polyester, Better Cotton, Zero Liquid Discharge (ZLD), renewable energy, circular fashion, ESG reporting, and Extended Producer Responsibility (EPR) to meet global environmental and buyer requirements. (Ministry of Textiles, Government of India, 2024; Textile Exchange, 2024).

Hotspots of the Indian apparel industry

The hotspots of the Indian apparel industry are concentrated in regions with strong garment manufacturing, skilled workforce, and export infrastructure. These clusters collectively support domestic production, exports, innovation, and employment, making India one of the world's leading apparel manufacturing and sourcing destinations.

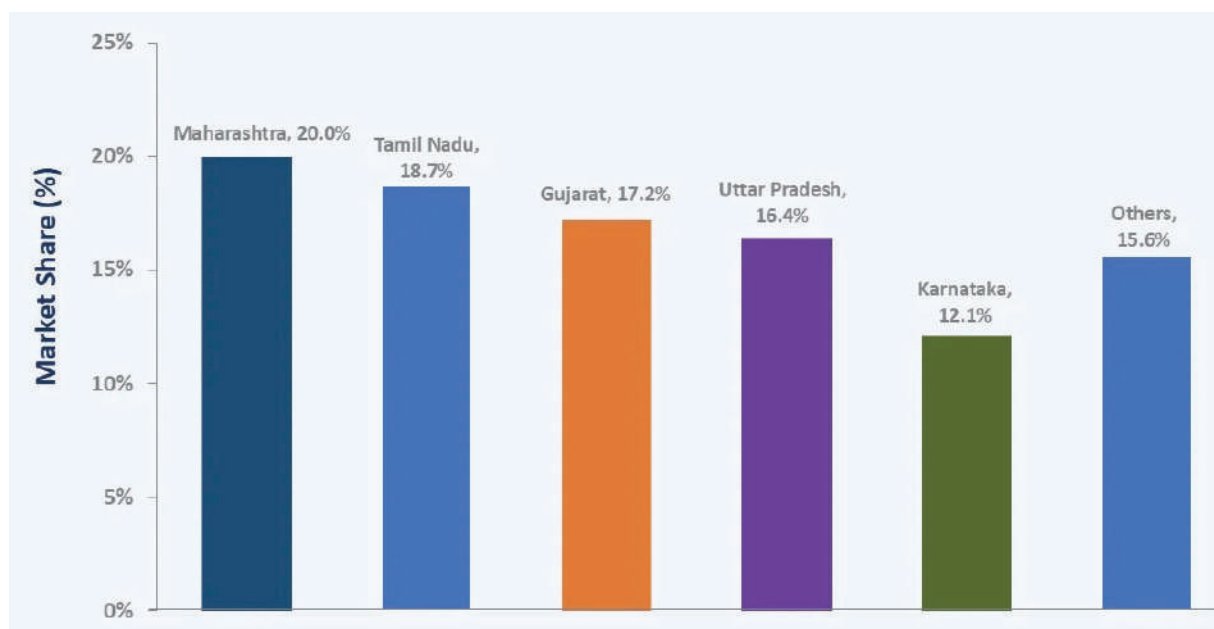


Fig. 1.1.7: Indian apparel industry hotspots

(Source: <https://www.imarcgroup.com/ckeditor/1c477989-f391-4df3-b6ea-4479eebeb895slide8.webp>)

The following are the hot spots of the Indian apparel industry:

- Tiruppur (Tamil Nadu) is India's leading apparel manufacturing hub for cotton knitwear and knitted garments, supplying high-quality apparel to domestic and international markets. (Ministry of Textiles, Government of India, 2024; AEPC, 2024).
- Bengaluru (Karnataka) is a major ready-made apparel manufacturing centre, known for large-scale garment production, apparel exports, and sourcing by global fashion brands. (AEPC, 2024; IBEF, 2025).
- Noida and Gurugram (Uttar Pradesh–Haryana NCR) form one of India's largest apparel export hubs, specialising in woven garments, fashion apparel, and export-oriented manufacturing. (Ministry of Textiles, Government of India, 2024).
- Mumbai (Maharashtra) is a prominent apparel business hub, recognised for fashion design, garment manufacturing, apparel merchandising, and export trade. (IBEF, 2025).

- Surat (Gujarat) is a leading synthetic apparel manufacturing centre, producing garments made from manufactured fibres and supplying fabrics for the apparel industry. (Ministry of Textiles, Government of India, 2024).
- Ludhiana (Punjab) is India's major winter apparel hub, specialising in knitted garments, hosiery, sweaters, and woollen apparel. (AEPC, 2024).
- Kolkata (West Bengal) is known for hosiery, ethnic apparel, and traditional garment manufacturing, serving both domestic and export markets. (Ministry of Textiles, Government of India, 2024).
- Jaipur (Rajasthan) is renowned for ethnic and handcrafted apparel, particularly garments featuring traditional block printing, embroidery, and artisan craftsmanship. (IBEF, 2025).

Garment and apparel regulatory bodies

The government bodies responsible for the policy, development, and regulation of India's apparel and garment industry are mainly the Ministry of Textiles, which is the primary, and the Ministry of Commerce and Industry. Apart from the ministries established under the Skill India Mission, the Apparel, Made-Ups & Home Furnishing Sector



Fig. 1.1.8: AMHSSC official logo

Skill Council (AMHSSC) is the dedicated Sector Skill Council for developing a skilled workforce for the apparel industry. It develops National Occupational Standards (NOSs), Qualification Packs (QPs), training curricula, assessment, and certification frameworks that align skill development with industry requirements. Through collaboration with industry, training providers, and government agencies, AMHSSC strengthens workforce productivity, employability, and the overall quality of the Indian apparel sector.

Sectors and sub-sectors of the apparel industry

The Indian apparel industry is part of the broader textiles and apparel sector. The Indian apparel industry reflects the apparel value chain from design to retail and export. Apart from that, the Indian apparel market is expected to grow from US\$115 billion in 2026 to US\$193 billion by FY2030, driven by expanding consumer demand and retail markets. (Statista, 2026; Grand View Research, 2026; India Brand Equity Foundation (IBEF), 2026). Based on consumer trends and patterns, the following are the different sectors and sub-sectors of the apparel industry:

Sector	Scope	Examples	Major apparel hubs
Apparel design and manufacturing	Covers the design, development, and production of garments from concept to finished products.	Casual wear, formal wear, ethnic wear, western wear, sportswear, activewear, children's wear, innerwear, denim wear, winter wear, workwear, uniforms, luxury apparel, sustainable apparel, and smart apparel.	Bengaluru (Karnataka), Tiruppur (Tamil Nadu), Noida–Gurugram (NCR), and Mumbai (Maharashtra) are major hubs for everyday and fashion apparel.

Sector	Scope	Examples	Major apparel hubs
Apparel merchandising and quality management	Covers product planning, sourcing, buyer coordination, and quality assurance throughout garment production.	Product planning, costing, buyer sampling, fabric inspection, in-line inspection, final inspection, quality testing, and compliance checks.	Jaipur (Rajasthan), Kolkata (West Bengal), Mumbai (Maharashtra), and Delhi NCR are known for traditional, ethnic, luxury, and designer apparel.
Apparel finishing, branding, and retail	Covers garment finishing, packaging, branding, marketing, and retail activities before products reach customers.	Thread trimming, pressing, folding, packing, tagging, labelling, brand promotion, fashion retail, and e-commerce.	Ludhiana (Punjab), Tiruppur (Tamil Nadu), Bengaluru (Karnataka), and Noida (Uttar Pradesh) are recognised for sportswear, children's wear, innerwear, winter wear, and workwear.
Apparel export, technology, and support services	Covers export operations, digital technologies, production planning, and sustainable manufacturing support.	Buying houses, export documentation, CAD/CAM, AI-based quality inspection, production planning, inventory management, and sustainable manufacturing.	Bengaluru (Karnataka), Tiruppur (Tamil Nadu), Surat (Gujarat), and Noida (Uttar Pradesh) are leading centres for sustainable and smart apparel.

Table 1.1.1: Major sectors of the apparel industry

Future trends of apparel industry

The global apparel market is projected to reach US\$1.92 trillion in 2026 and US\$2.5 trillion by 2033, while the Indian apparel market is expected to grow from US\$115 billion in 2026 to US\$193 billion by FY2030, driven by expanding consumer demand and retail markets. (Statista, 2026; Grand View Research, 2026; India Brand Equity Foundation (IBEF), 2026). Digital transformation, automation, AI, 3D designs, and smart manufacturing drive the future of the apparel industry. These technologies improve productivity, quality, and efficiency. Sustainability, circular fashion, recycled materials, ethical sourcing, and ESG compliance are shaping industry growth.

With the rapid advancement of digital technologies, the smart apparel industry is expected to become the future of apparel manufacturing by integrating smart fabrics, wearable sensors, artificial intelligence (AI), the Internet of Things (IoT), and digital manufacturing to produce intelligent, functional, and sustainable garments.

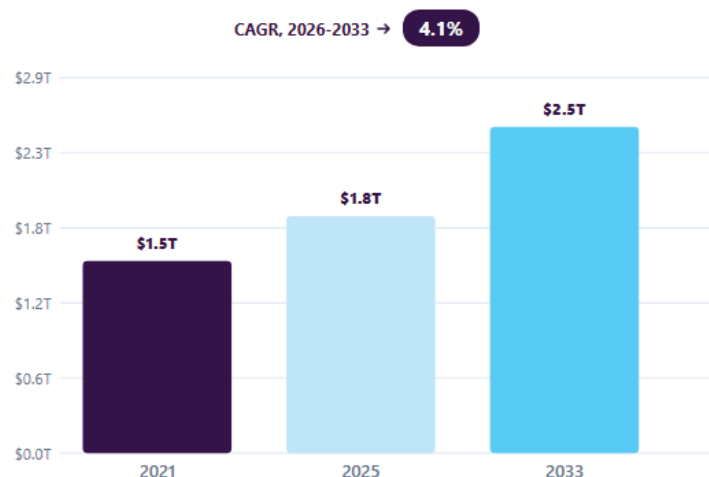


Fig. 1.1.9: Future growth trends of apparel industry
(<https://www.grandviewresearch.com/static/img/research/apparel-market-snapshot.webp>)



Fig. 1.1.10: Smart apparel industry

In India, rising demand, e-commerce, technical textiles, and initiatives such as PM MITRA and the PLI Scheme are expected to boost manufacturing, exports, employment, and innovation (Ministry of Textiles, 2025; IBEF, 2025):

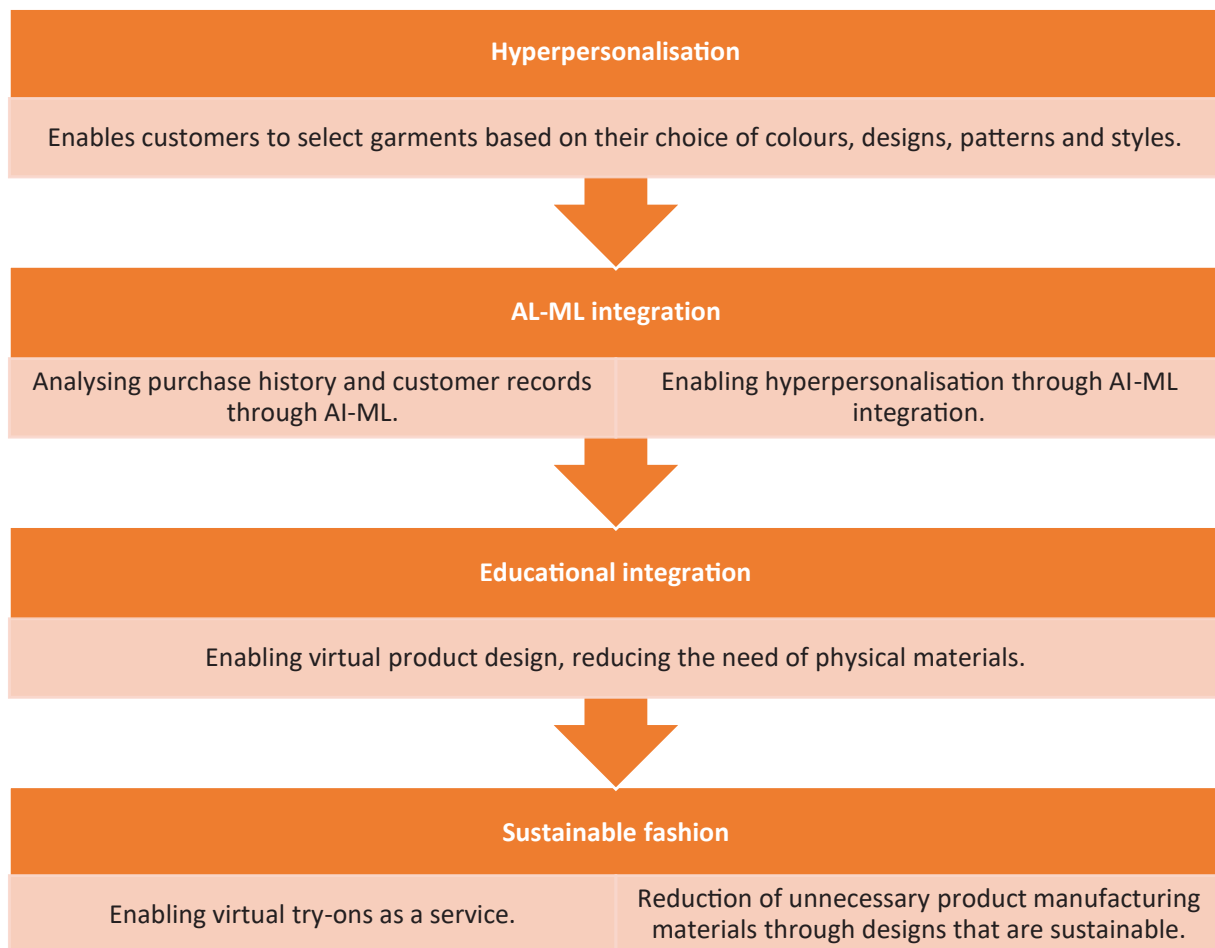


Fig. 1.1.11: Future trends of the Indian apparel industry

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1.1.2 Apparel Industry Size and Scope

An apparel quality analyst is primarily required in the apparel manufacturing and quality assurance sub-sector, where the need arises during fabric inspection, garment production, in-line and final inspections, and pre-shipment quality checks to ensure products meet customer specifications and industry standards.

Who is an apparel quality analyst?

An apparel quality analyst is a professional responsible for inspecting raw materials, garments, and production processes to ensure they meet specified quality standards, customer requirements, and industry regulations. They identify defects, analyse quality data, recommend corrective actions, and support continuous improvement to enhance product quality, customer satisfaction, and manufacturing efficiency.



Fig. 1.1.12: Apparel quality analyst in AQL inspection

Job role and responsibilities:

An apparel quality analyst plays a vital role in ensuring that garments meet the required quality standards, customer specifications, and regulatory requirements throughout the manufacturing process. Their primary job roles and responsibilities include the following:

Job Role	Responsibilities
Inspect garments and raw materials	Inspect fabrics, trims, accessories, and finished garments to identify defects and verify compliance with specified quality standards.
Classify and analyse defects	Identify, classify, and record garment defects as major or minor based on defect type, frequency, severity, and customer quality requirements.
Monitor production quality	Monitor quality at different stages of production, including fabric inspection, pattern verification, cutting, stitching, finishing, and packing.
Analyse quality data	Analyse inspection reports, production records, and defect data to identify trends, root causes, and process-related quality issues.
Maintain quality documentation	Prepare and maintain production records, inspection reports, trim cards, measurement charts, control charts, samples, SOPs, and quality documents.
Use digital and AI-based quality tools	Operate AI-enabled inspection systems, digital dashboards, and analytics tools to monitor quality metrics, detect defects, and improve production efficiency.
Apply quality control techniques	Use quality control tools such as Pareto charts, Fishbone (Ishikawa) diagrams, check sheets, and CAPA techniques to improve product quality.
Prepare reports and visual dashboards	Develop quality reports, charts, dashboards, and visual defect boards to communicate inspection findings and support management decision-making.
Implement corrective and preventive actions	Recommend and monitor corrective and preventive actions to eliminate recurring defects and improve manufacturing processes.

Table 1.1.2: Apparel quality analyst job role and responsibilities

1.1.3 Apparel Quality Analyst Career Pathways

The career pathway of an apparel quality analyst consists of employment opportunities and career progression within the apparel industry. It outlines the organisations where professionals can work and the different roles they can advance to with experience, skills, and qualifications.

Employment opportunities:

An apparel quality analyst can find employment opportunities across various sectors and industries involved in apparel manufacturing, quality assurance, retail, and exports, including the following:

- **Apparel manufacturing industry**

Apparel Quality Analysts are employed in garment manufacturing units to inspect raw materials, monitor production quality, and ensure finished garments meet customer specifications. They support quality assurance throughout the manufacturing process.

- **Textile manufacturing industry**

Textile mills and fabric manufacturing companies employ quality analysts to inspect fibres, yarns, fabrics, and finished textiles before they are supplied for garment production. They ensure materials conform to required quality standards.

- **Export and buying houses**

Export houses and buying agencies recruit quality analysts to inspect garments before shipment and verify compliance with international buyer specifications. They help maintain export quality and customer satisfaction.

- **Fashion and retail industry**

Fashion brands and retail companies employ quality professionals to maintain product quality across sourcing, production, and retail operations. They ensure consistency in products delivered to customers.

- **Testing and inspection services**

Independent testing laboratories and inspection agencies employ Apparel Quality Analysts to evaluate garment quality, conduct testing, and certify compliance with industry standards. They provide third-party quality verification services.

- **E-commerce and warehousing**

E-commerce companies and distribution centres employ quality analysts to inspect products before storage, packaging, and dispatch. They help minimise product returns by ensuring consistent product quality.

- **Technical textile industry**

Manufacturers of technical and specialised textile products employ quality analysts to verify product performance, durability, and compliance with technical specifications. They support quality assurance for industrial and functional textiles.

- **Government and skill institutions**

Government organisations, SC quality certification bodies, and skill development institutions employ experienced quality professionals as trainers, assessors, auditors, and technical experts. They contribute to workforce development and quality standardisation across the industry.

Career progression:

After apparel quality analyst, professionals can progress to higher roles with greater responsibilities, leadership opportunities, and specialised expertise in quality management, as outlined below:

- **Senior quality analyst**

Senior Quality Analysts supervise quality inspections, mentor junior quality professionals, and coordinate quality improvement activities across production. They monitor quality performance and ensure consistent compliance with quality standards.

- **Quality assurance executive**

Quality Assurance Executives manage quality systems, oversee inspections, implement quality policies, and ensure compliance with customer, organisational, and regulatory requirements. They also lead corrective and preventive quality initiatives.

- **Quality assurance manager**

Quality Assurance Managers lead the quality department, develop quality strategies, manage audits, and drive continuous improvement across manufacturing operations. They are responsible for achieving product quality, customer satisfaction, and operational excellence.

- **Technical quality consultant and auditor**

Experienced professionals may progress as technical quality consultants and auditors, providing expert guidance on quality systems, conducting audits, ensuring regulatory compliance, and optimising manufacturing processes across apparel organisations.

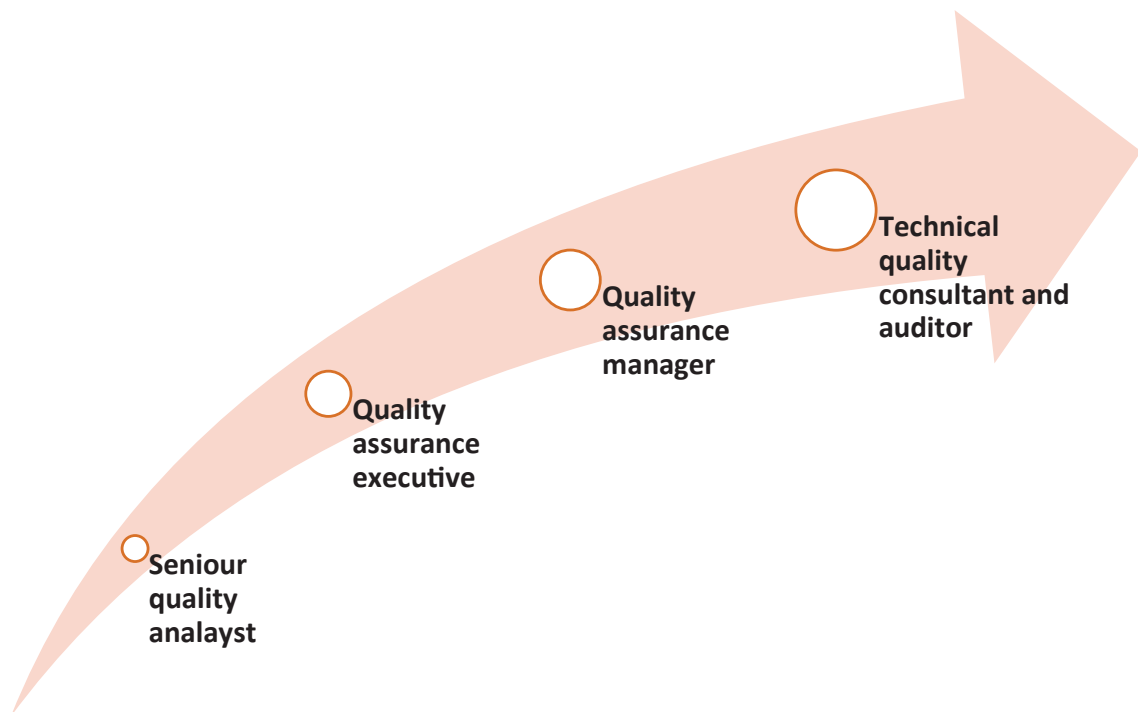


Fig. 1.1.13: Career progression for apparel quality analyst

1.1.4 Quality Analyst Impact in Manufacturing

An apparel quality analyst performs quality assurance activities across different apparel manufacturing segments to ensure garments comply with customer specifications, quality standards, and regulatory requirements. Each segment uses a standard inspection tool or checklist to maintain consistent product quality. The following are the impacts of quality analyst's impact in apparel manufacturing:

Manufacturing Role	Action	Impact on Manufacturing
General apparel manufacturing	The apparel quality analyst inspects menswear, womenswear, casualwear, and formalwear for measurements, stitching, workmanship, appearance, and finishing using the Garment Quality Inspection Checklist.	Ensures consistent garment quality, reduces production defects, and improves customer satisfaction.
Specialised apparel manufacturing	The apparel quality analyst evaluates sportswear, workwear, innerwear, and technical garments for performance, durability, safety, comfort, and functionality using the Technical Apparel Inspection Checklist.	Ensures compliance with functional and safety standards while enhancing product reliability and performance.

Manufacturing Role	Action	Impact on Manufacturing
Traditional apparel manufacturing	The apparel quality analyst examines ethnic wear and designer garments for embroidery, embellishments, fit, construction quality, and premium finishing using the Finished Garment Inspection Checklist.	Maintains premium craftsmanship, preserves design quality, and meets customer and brand expectations.
Children's apparel manufacturing	The apparel quality analyst inspects infant and children's garments for sizing, comfort, durability, accessory attachment, and safety using the Kidswear Safety Inspection Checklist.	Ensures child safety, regulatory compliance, and high product quality while reducing customer complaints and product recalls.

Table 1.1.3: Apparel manufacturing quality impact on manufacturing

The manufacturing roles above cover all major apparel categories, with final apparel quality inspection checklists ensuring compliance with material, workmanship, safety, functionality, finishing, and customer quality requirements.

P/O No	3820CC	Client					
Style No	122034	Buyer					
Product Manager		Factory Name					
Report To	Patrik	Inspection Location	GURGOAN				
Inspection Performed	[] Initial Insp [] Mid Insp [X] Final Insp [] Re-Insp						
From	- Delhi	Inspection Date	2nd Feb 2017				
Product description	Men Shirt Full sleeve						
Colors Ordered			Size Ordered				
	30	32	34	36	38	40	
122034 -AQUA	7	20	36	31	20	11	125
122034 -BLUE	6	24	35	30	19	11	125
122034 -PUTTY	3	31	35	38	9	9	125
							375
Colors inspected			Size Inspected				
	30	32	34	36	38	40	
122034 -AQUA	7	21	37	32	21	12	130
122034 -BLUE	6	25	36	31	20	12	130
122034 -PUTTY	3	32	36	39	10	10	130
							390
COLOR	Order Qty	IRF required qty	Packed qty	Not packed qty	sampled from		
	375	390	390		packed Qty		
					50		
SHORTAGE							
Total	375	390	390		50		

CHECK LIST-- CATEGORY		ACCEPT				COMMENTS	
QUANTITY		YES	X	NO		15 PCS OVERAGE	
Product Descreption/color/style		YES	X	NO			
Workmanship/Materials		YES	X	NO			
Measurment		YES	X	NO		See attached spec report	
Packing		YES	X	NO			
Shipping Mark		YES	X	NO			
Test reports		YES		NO	X		
Inspection Slandered -- AQL 2.5 Major & 4-Minor					TOTAL POINTS		
sampling plan - Single, Normal					MAJOR		MINOR
inspection level II		Maximum Point Allowed			3		5
		Total Points Found			3		2
Conclusion		Reject			Accept		X
					Conditionally Approved		

Fig. 1.1.14: Apparel final quality inspection report

Summary

- The apparel industry is one of the largest manufacturing sectors, producing garments for domestic and global markets.
- The apparel production process includes design, fabric sourcing, cutting, stitching, finishing, inspection, and packaging.
- An Apparel Quality Analyst ensures that garments meet the required quality standards before reaching customers.
- The Quality Analyst checks fabric, stitching, measurements, appearance, and finishing during production.
- Maintaining product quality helps reduce defects, rework, and customer complaints.
- The Apparel Quality Analyst follows quality standards, inspection procedures, and company guidelines.
- Quality checks are performed at different stages of manufacturing to detect defects early.
- An Apparel Quality Analyst works closely with production teams to improve product quality.
- Career opportunities are available in garment factories, export houses, buying offices, retail brands, and quality inspection agencies.
- The role requires attention to detail, observation skills, communication, and problem-solving abilities.
- Effective quality control improves customer satisfaction and enhances the reputation of the organisation.
- The Apparel Quality Analyst plays an important role in ensuring consistent quality throughout the apparel manufacturing process.

Exercise

Multiple-choice Question:

1. What is the primary responsibility of an Apparel Quality Analyst?
 - a. To design garments
 - b. To inspect and ensure garment quality
 - c. To manage employee salaries
 - d. To advertise products
2. Which stage is NOT a part of the apparel production process?
 - a. Cutting
 - b. Stitching
 - c. Finishing
 - d. Banking
3. Why are quality inspections carried out during manufacturing?
 - a. To increase production cost
 - b. To identify and correct defects early
 - c. To reduce worker attendance
 - d. To delay production
4. Which of the following is a common workplace for an Apparel Quality Analyst?
 - a. Hospital
 - b. Export house
 - c. Bank
 - d. School
5. Which skill is most important for an Apparel Quality Analyst?
 - a. Singing
 - b. Attention to detail
 - c. Driving
 - d. Cooking

Descriptive Questions:

1. Explain the size and scope of the apparel industry.
2. Describe the roles and responsibilities of an apparel quality analyst.
3. List any two career opportunities available for an apparel quality analyst.
4. Explain the stages of the apparel production process where quality inspection is performed.
5. Describe the importance of an apparel quality analyst in maintaining product quality during manufacturing.

This image shows a full page of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for handwriting practice or general writing. There are no margins, text, or other markings on the page.

Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/5dLX8mRAE88>

Apparel industry in India





2. Analyse and Classify Garment Defects in Apparel Production

Unit 2.1 - Garment Defects and Quality Evaluation

Unit 2.2 - Quality Documentation and Inspection Practices



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Describe common garment defects, their causes, and the methods used to identify, classify, and handle them.
2. Compare major and minor garment defects based on their type, severity, frequency, and quality standards, and evaluate their impact on garment quality and customer satisfaction.
3. Explain the garment production process and correlate fabric, material, and process-related issues with garment defects and their root causes.
4. Interpret inspection reports and defect records to identify defect patterns, production trends, and opportunities for quality improvement.
5. Prepare visual defect classification boards, standard operating procedures (SOPs), and defect documentation using photographs, timestamps, and traceability records.
6. Discuss safe workplace inspection practices, garment defect validation after repairs, and benchmarking of defect rates against organisational and industry quality standards.

UNIT 2.1: Garment Defects and Quality Evaluation

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe common garment defects, their causes, and methods of identification, classification, and correction.
2. Compare major and minor garment defects by type, severity, frequency, and quality standards, and evaluate their impact on quality and customer satisfaction.
3. Explain the garment production process and correlate defects with fabric, material, and process issues.
4. Prepare inspection reports and defect data to identify trends, evaluate production performance, and improve quality.

2.1.1 Garment Defect Management

What is understood by garment defects?

Garment defects are faults or imperfections in a garment that reduce its quality, functionality, appearance, or compliance with customer specifications and industry standards. They may occur during fabric production, cutting, stitching, finishing, or packaging and can result in product rejection, rework, or customer complaints. The following are some common garment defects that an apparel quality analyst must be well aware of:

- **Puckering**

Puckering is the formation of unwanted wrinkles or ridges along stitched seams due to uneven fabric tension, incorrect stitching, or fabric shrinkage. It affects the garment's appearance, fit, and overall quality.

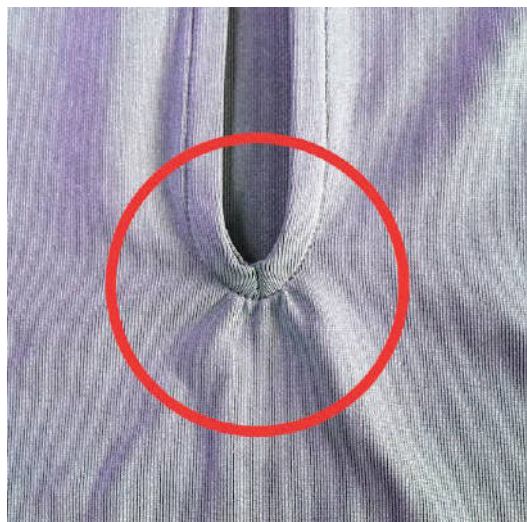


Fig. 2.1.1: Garment puckering

- **Open seam**

An open seam occurs when stitched seams separate because of broken stitches, inadequate seam allowance, or poor stitching quality. This defect weakens the garment and reduces its durability.



Fig. 2.1.2: Garment open seam

- **Misalignment**

Misalignment occurs when garment parts, patterns, stripes, checks, pockets, collars, or seams do not align correctly during assembly. It affects the garment's appearance, symmetry, and customer acceptance.



Fig. 2.1.3: Garment misalignment

What is understood by garment defect management?

Garment defect management is the systematic process of identifying, classifying, analysing, and correcting defects throughout the apparel manufacturing process. It ensures garments conform to customer specifications, quality standards, and regulatory requirements while reducing rework, wastage, production costs, and customer complaints. The following are the components of garment defect management:

- **Fabric defect identification**

The apparel quality analyst inspects all categories of apparel, including menswear, womenswear, children's wear, sportswear, workwear, casualwear, formalwear, innerwear, ethnic wear, and designer wear, for defects such as holes, stains, weaving faults, slabs, and shade variations. Fabric quality is commonly assessed using the 4-Point Fabric Inspection System, where:

- Fabric Defect Score = $(\text{Total Defect Points} \times 100) \div \text{Total Fabric Length (yards)}$
- The calculated score determines whether the fabric meets the acceptable quality limit.

- **Measurement defect identification**

The apparel quality analyst verifies garment dimensions against approved specifications to ensure proper fit and consistency across all apparel categories. Measurement accuracy is determined using:

- Measurement Deviation = Actual Measurement – Specified Measurement
- Garments are accepted when deviations remain within the prescribed tolerance limits.

- **Workmanship defect identification**

The apparel quality analyst examines stitching, seams, hems, button attachment, zippers, embroidery, labels, and overall garment construction to identify manufacturing defects. Production quality is monitored using:

- Defect Percentage (%) = (Number of Defective Garments ÷ Total Garments Inspected) × 100
- A lower defect percentage indicates better manufacturing quality.

- **Appearance defect identification**

The apparel quality analyst evaluates garment appearance by checking colour consistency, symmetry, finishing, printing, embellishments, pressing, and packaging before product approval. Final garment acceptance is determined using the Acceptable Quality Level (AQL) sampling method, based on the number of defects detected within the inspection sample.

AQL sampling parameter	Calculation and description
Lot size	Total number of garments in the production batch to be inspected (e.g., 5,000 garments).
Sample size	Number of garments selected for inspection based on the AQL sampling table (e.g., 200 garments for a lot of 5,000 at General Inspection Level II).
Defects found	Total number of major and/or minor defects identified in the inspected sample (e.g., 8 major defects).
Acceptance decision	Compare the defects found with the Acceptance Number (Ac) and Rejection Number (Re) from the AQL table. Example: At AQL 2.5, for a sample size of 200, Ac = 10 and Re = 11. If defects ≤ 10, Accept the lot; if defects ≥ 11, Reject the lot.
Defect percentage	Defect Percentage (%) = (Number of Defective Garments ÷ Sample Size) × 100. Example: (8 ÷ 200) × 100 = 4% defect rates. This value supports quality trend analysis, while the final acceptance is based on the AQL acceptance number.

Table 2.1.1: Apparel AQL sampling guidelines

- **Functional defect identification**

The apparel quality analyst assesses specialised apparel such as sportswear, workwear, children's wear, innerwear, and technical garments for durability, comfort, seam strength, stretchability, colour fastness, and safety requirements. Test results are compared with customer specifications and applicable quality standards before approving the garments.

Product name			
Product reference			
Date		IP rights	This document is [client company name]'s property.

REVISION HISTORY				
Rev.	Description of change	Page No.	Author	Date
0	Document creation:	--		
1				
2				
3				
4				
5				

Fig. 2.1.4: Customer specification sheet

- **Defect trend analysis**

The apparel quality analyst analyses inspection data to identify recurring defects, determine root causes, and recommend corrective and preventive actions for continuous quality improvement. This helps improve manufacturing efficiency, minimise quality deviations, and enhance customer satisfaction.

[illegible]

Fig. 2.1.5: Defect trend analysis template

2.1.2 Major and Minor Garment Defects

The classification of major and minor garment defects helps the apparel quality analyst determine product acceptability, prioritise corrective actions, and ensure compliance with customer quality standards and Acceptable quality level (AQL) requirements.

What is a major garment defect?

A major garment defect is a significant fault that affects the garment's appearance, fit, functionality, durability, or compliance with customer specifications, making it unacceptable for sale without correction. Major defects usually result in garment rejection, repair, or rework during quality inspection. The following are the different types of major garment defects:

- **Measurement defects**

Measurement defects occur when garment dimensions exceed the specified tolerance, resulting in poor fit and non-compliance with customer specifications. For example, a pair of trousers has an inseam length that is significantly shorter than the approved measurement.

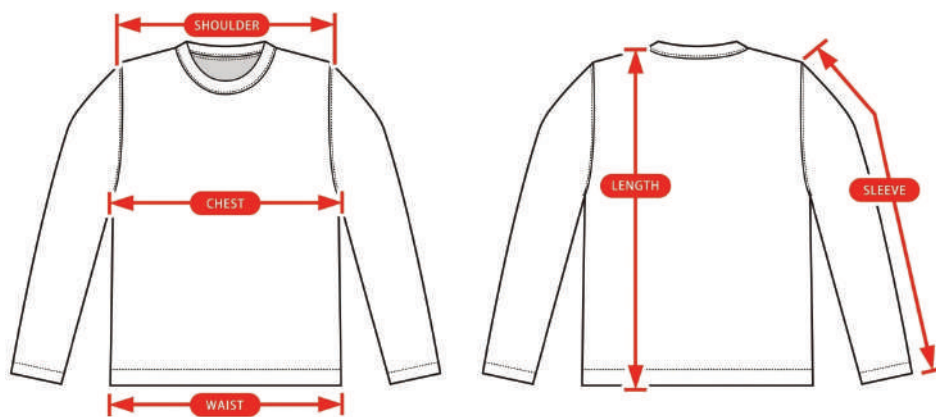


Fig. 2.1.6: Garment defect due to measurement

- **Fabric defects**

Fabric defects include holes, tears, stains, major shade variations, weaving faults, or other imperfections that affect the garment's appearance, durability, and overall quality. For example, a visible hole is found on the front panel of a T-shirt during final inspection.



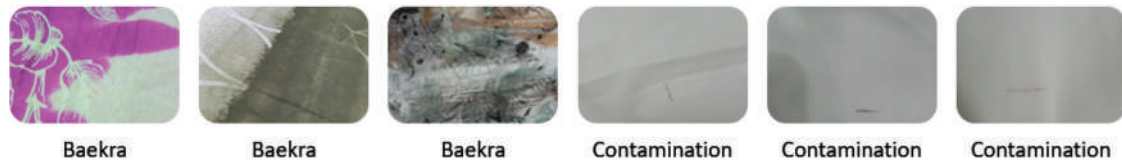


Fig. 2.1.7: Fabric defect

- Construction defects**

Construction defects occur when garment components are assembled incorrectly or essential parts are missing, affecting the garment's functionality and performance. For example, a jacket is stitched with an inverted sleeve or is missing its front zipper, making it unacceptable for sale.



Fig. 2.1.8: Garment construction defects

- Functional defects**

Functional defects occur when a garment fails to perform its intended purpose due to inadequate strength, poor fastening, or failure to meet performance requirements. The following are the different types of functional defects in garments:

Functional Defect	Description	Example
Faulty zipper	The zipper does not open, close, or lock smoothly, affecting the garment's functionality.	A jacket zipper gets stuck midway and cannot be fully closed.

Functional Defect	Description	Example
Weak seam strength	Seams fail to withstand normal pulling or stretching during use due to poor stitching or weak thread.	The side seam of sportswear tears during regular movement.
Loose or missing fasteners	Buttons, hooks, snaps, or Velcro are loose, incorrectly attached, or missing, reducing garment usability.	A shirt button falls off after the first use.
Poor elastic performance	Elastic bands lose stretch or fail to recover, affecting fit and comfort.	The waistband of track pants becomes loose after a few wears.
Poor colour fastness	The garment loses colour during washing, rubbing, perspiration, or exposure to light.	A dark blue T-shirt fades noticeably after its first wash.
Insufficient water resistance	Protective garments fail to resist water or moisture as specified.	A raincoat allows water to seep through during light rainfall.
Poor breathability	The fabric does not provide adequate air circulation, causing discomfort during use.	A sports jersey traps excessive heat during physical activity.
Faulty reflective elements	Reflective tapes or trims fail to provide the required visibility under low-light conditions.	The reflective strips on a safety jacket are barely visible at night.

Table 2.1.2: Common functional garment defects

What is a minor garment defect?

A minor garment defect is a small imperfection that does not affect the garment's fit, functionality, durability, or intended use but may slightly affect its appearance. Minor defects are generally acceptable within specified quality limits and usually do not require garment rejection. The following are the different types of minor garment defects:

- **Appearance defects**

Appearance defects are minor imperfections that slightly affect the visual appeal of a garment without impacting its fit, durability, or functionality. The following are the different kinds of appearance defects:

Appearance Defect	Description	Example
Surface defects	Visible imperfections on the garment surface, such as stains, shade variation, loose threads, or fabric marks, that affect appearance but not functionality.	A small oil stain or slight colour variation is visible on a shirt.
Stitching defects	Minor irregularities in stitching, seam appearance, or puckering that do not affect garment strength or usability.	Slight puckering is visible along the sleeve seam of a shirt.
Decoration defects	Minor misalignment or uneven finishing of prints, embroidery, labels, or trims that affect visual appeal.	The embroidered logo is stitched slightly above the approved position.

Appearance Defect	Description	Example
Finishing defects	Imperfections in pressing, folding, labelling, or packaging that affect garment presentation without impacting performance.	The garment has light pressed marks or is folded unevenly before packing.

Table 2.1.3: Common garment appearance defects

- Minor measurement deviations**

Minor measurement deviations occur when garment dimensions vary slightly but remain within the allowable tolerance specified by the buyer. For example, a shirt sleeve is 0.5 cm longer than the standard measurement but is still within the accepted tolerance.

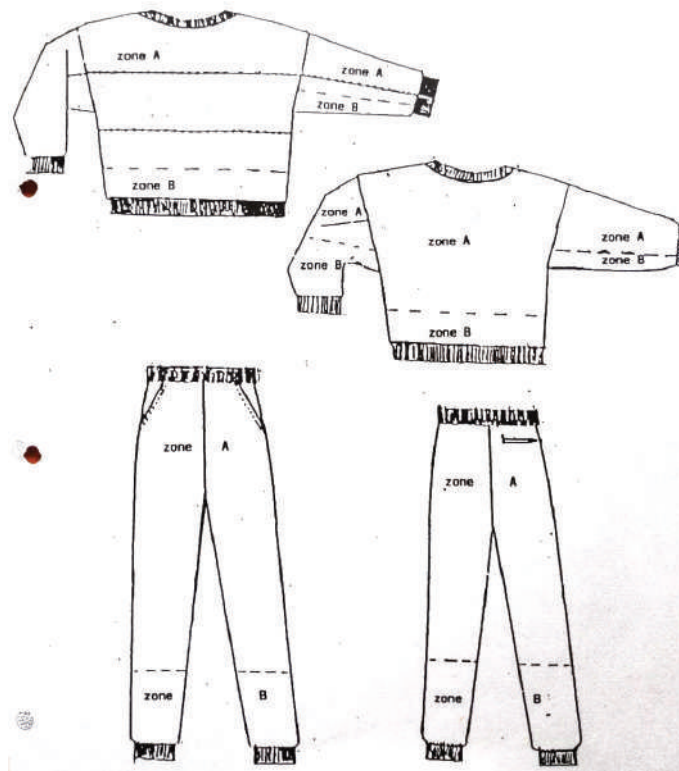


Fig. 2.1.9: Minor garment measurement defect sample

- Minor construction defects**

Minor construction defects include small stitching irregularities or slight alignment variations that do not affect the garment's strength or usability. The following are the different types of minor construction defects:

Construction Defect	Description	Example
Minor stitching defects	Slight stitching irregularities, such as skipped stitches or uneven stitch density, that do not affect garment strength or durability.	A few skipped stitches are present on the sleeve hem, but the seam remains secure.

Construction Defect	Description	Example
Minor seam defects	Small seam irregularities, such as slight seam puckering or uneven seam allowance, that do not affect garment functionality.	The side seam shows slight puckering without causing seam opening.
Minor component defects	Slight misalignment or uneven attachment of garment components that does not affect their intended use.	A pocket is stitched a few millimetres above the approved position.

Table 2.1.4: Minor garment construction defects

- **Minor finishing defects**

Minor finishing defects include slight imperfections in trimming, ironing, labelling, or packaging that do not affect garment performance or customer use. The following are the different types of minor finishing defects in garments:

Finishing Defect	Description	Example
Pressing defects	Minor wrinkles, light shine marks, or uneven pressing that slightly affect the garment's appearance without impacting its performance.	A shirt has light crease marks after pressing that can be removed easily.
Thread trimming defects	Small untrimmed or loose threads remain after garment assembly, affecting the finished appearance.	A few loose threads are visible near the sleeve cuff.
Labelling defects	Slight misalignment or improper attachment of brand, size, or care labels that does not affect garment use.	The care label is stitched slightly off-centre inside the garment.
Packaging defects	Minor imperfections in folding, tagging, or packing that affect product presentation but not garment quality.	A garment is folded unevenly or the swing tag is attached incorrectly before dispatch.

Table 2.1.5: Minor garment finishing defects

2.1.3 Production Process Defect Correlation

What is understood by production process defects?

Production process defects are faults or quality issues that occur during different stages of garment manufacturing, such as fabric inspection, cutting, stitching, finishing, or packaging, due to errors in materials, machines, methods, or workmanship. These defects affect the garment's quality, functionality, appearance, or compliance with customer specifications and may require correction, rework, or rejection.

What is garment defect categorisation?

Garment defect categorisation is the process of classifying garment defects according to their type, frequency of occurrence, and the garment section where they are found, such as collars, sleeves, seams, or hems. It helps the apparel quality analyst identify defect patterns, prioritise corrective actions, and improve overall product quality and manufacturing efficiency. The following are the different types of garment defect categorisation with their parameters:

Garment type defects:

Type in garment production and manufacturing refers to the classification of garments based on their design, construction, and production process. It determines the machinery, production methods, workforce skills, and quality requirements. Type defects in garment manufacturing are defects classified by their nature, such as fabric, stitching, measurement, finishing, or trimming defects. This classification helps identify quality issues and improve production, as follows:

- **Cut-and-sew garment defects**

These defects occur in garments made by cutting fabric pieces and stitching them together, commonly seen in both woven and knit constructions. They include issues in alignment, stitching quality, sizing, and finishing during assembly. For example, a shirt or T-shirt showing uneven seams, twisted parts, or poor stitch quality due to cutting and sewing errors.

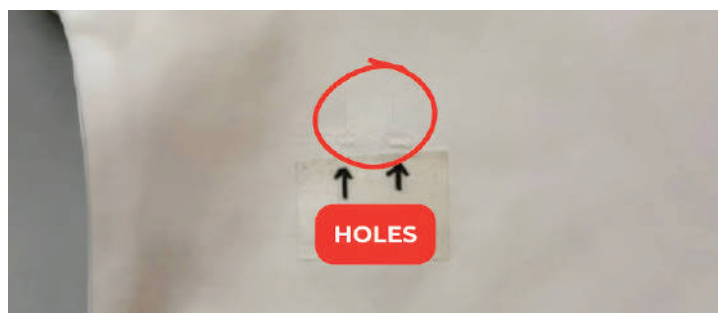


Fig. 2.1.10: Cut and sew garment defects

- **Knitted garment construction defects**

These defects occur in garments produced using knitting techniques such as fully fashioned or seamless tubular methods, where shaping is done through knitting itself. They are mainly related to loop formation, panel shaping, and structural consistency. For example, a sweater or seamless leggings with uneven shaping, visible lines, or inconsistent fit due to knitting faults.



Fig. 2.1.11: Knitted garment construction defects

- **Tailored and structured garment defects**

These defects occur in garments designed with structured construction and internal support to achieve a formal and fitted appearance. They are usually linked to shaping accuracy, balance, and assembly of components like collars, shoulders, and lapels. For example, a blazer or structured jacket with poor shoulder alignment, uneven lapels, or improper shaping.



Fig. 2.1.12: Tailored and structured garment defects

- **Mass and custom production garment defects**

These defects occur in garments produced either in large-scale standard sizing or made-to-measure systems, where consistency and accuracy are critical. They are mainly related to measurement errors, finishing faults, and fit variations. For example, a ready-to-wear shirt or custom suit with incorrect sizing, poor fit, or missing finishing details like buttons or hems.



Fig. 2.1.13: Mass and custom production garment defects

Garment frequency defects:

Garment frequency defects refer to the classification of defects based on how often they occur during production. It helps in identifying repeated or occasional quality issues, enabling prioritisation of corrective actions and process improvement. Frequency defects in garment manufacturing are grouped based on recurrence patterns such as frequent, occasional, or rare defects observed in production. This classification helps monitor process stability and improve overall quality control, as follows:

Defect frequency type	Description	Cause and nature	Example
Frequent defects	These defects occur repeatedly during production and indicate a consistent process or machine-related issue that requires immediate correction.	Usually linked to ongoing problems in stitching, fabric handling, or machine settings affecting continuous production.	Continuous thread breakage or repeated skipped stitches in a shirt production line.
Occasional defects	These defects occur intermittently and are not present in every garment but appear at irregular intervals during production.	Caused by operator variation, minor machine fluctuations, or inconsistency in material quality.	Occasional seam puckering or uneven hemming in selected garments from the batch.
Rare defects	These defects occur infrequently and are usually isolated incidents caused by unusual errors or rare material faults.	Not systematic and usually arises from one-time operator or fabric issues.	A single garment showing a fabric hole or severe misalignment in an otherwise correct batch.

Table 2.1.6: Garment frequency defects

Garment department defects:

Garment department/section defects refer to the classification of defects based on the specific part or section of the garment where the quality issue occurs. It helps in identifying problem-prone areas such as collars, sleeves, seams, or hems, enabling targeted inspection and process improvement. Section-based defects in garment manufacturing are grouped according to the location of defects within the garment structure, such as upper body, lower body, closures, or finishing sections. This classification helps improve section-wise quality control and production accuracy, as follows:

Garment section defect type	Description	Cause and nature	Example
Upper garment section defects	These defects occur in the upper part of the garment, such as the collar, neckline, shoulders, sleeves, and chest area.	Usually caused by improper alignment, stitching errors, or pattern inaccuracies in upper body construction.	A shirt with a misaligned collar or uneven shoulder seams in the upper section.
Lower garment section defects	These defects occur in the lower part of the garment, including waistbands, hips, inseam, outseam, and hem areas.	Commonly caused by measurement errors, incorrect stitching, or fabric distortion during assembly.	Trousers with uneven leg lengths or twisted side seams in the lower section.
Closure and attachment section defects	These defects occur in areas where functional components like zippers, buttons, hooks, and fasteners are attached.	Usually due to improper placement, poor stitching strength, or alignment issues.	A jacket with a misaligned zipper or loose button attachment in the closure section.

Table 2.1.7: Garment section defects

What is understood by production process defect correlation?

Production process defect correlation refers to the relationship between different defects and the specific stages of the garment manufacturing process where they occur. It helps identify how issues in one process, such as cutting or stitching, can lead to related defects in later stages, enabling better root-cause analysis and process control. The following are the calculations that must be taken into account to identify the defects and prevent them from happening. The following are the stages of production and process defect correlation:

Defect Attribution Calculation

A factory producing 1,000 garments in a day recorded 80 defective pieces during final inspection. This helps in understanding how defects are distributed across different production stages. The defects are further divided into cutting and stitching to identify the root cause.

- Cutting defect rate**

Cutting-related defects account for 30 garments out of 1,000, giving a defect rate of 3%. These defects usually originate during the fabric cutting stage such as wrong panel shapes, uneven cuts, or size variations. The root cause is generally linked to marker planning, fabric laying, or cutting machine errors.

- **Stitching defect rate**

Stitching-related defects account for 50 garments out of 1,000, resulting in a 5% defect rate. These defects occur during the sewing process and include issues like open seams, skipped stitches, and uneven stitching. They are typically caused by machine settings, operator skill level, or thread quality.

- **Cutting stage interpretation**

Cutting-stage defects stem from fabric preparation and cutting errors—such as faulty marker making or laying—which directly compromise panel alignment and final garment dimensions before assembly begins.

- **Stitching stage interpretation**

Stitching-stage defects arise during garment assembly due to sewing line variables—such as improper machine tuning, operator handling, or thread performance—directly impacting the garment's visual appearance, structural strength, and final finish.

Fig. 2.1.14: Defect Attribution Calculation

Defect categorisation helps in identifying the severity of quality issues so that corrective actions can be prioritised at the correct stage of production. Based on the scoring, the defects can be attributed a particular priority shown below:

DEFECT DESCRIPTION	DEFECT CLASSIFICATION		
	CRITICAL	MAJOR	MINOR
SMALL LOOSE THREADS,			✓
SLIGHT COLOR VARIATION			✓
BROKEN ZIPPERS		✓	
FABRIC DAMAGE		✓	
INCORRECT SIZING	✓		

Fig. 2.1.15: Garment defect classification matrix

2.1.4 Inspection Report and Analysis

Inspection Report and Analysis records the defects identified during garment inspection and summarises the quality status of the production batch. It analyses defect patterns, frequencies, and root causes to support corrective actions and improve product quality.

Different types of inspection reports

- **Pre-production inspection**

This stage evaluates raw materials, trims, and suppliers before production starts to ensure they meet quality requirements and minimise the risk of manufacturing defects.

Document # _____ Document Date _____

Date	Sample #	Customer Name	Product	Dimension of sample	Review Date	Review Details

Reviewed by _____ Sign _____ Date _____

Manager Production Sign _____

Fig. 2.1.16: Pre-inspection report sample

- **Fabric testing**

Fabric is inspected for properties such as GSM, shrinkage, colour fastness, width, and tensile strength using standard testing equipment and fabric inspection checklists. The test results are compared with buyer specifications, and any non-conformities are recorded in the inspection report before approving the fabric for production.

- **Supplier vetting**

Suppliers are assessed based on their product quality, delivery performance, certifications, and compliance with organisational standards using a supplier evaluation scorecard or vendor audit checklist. The evaluation results are analysed to approve reliable suppliers and reduce the possibility of material-related defects during production.

- **In-process inspection**

This stage monitors garment quality throughout production by inspecting work at different operations to identify defects early and prevent their recurrence in subsequent processes.

BODICE MEASUREMENTS	CM/INCH	PANT MEASUREMENTS	CM/INCH
☐ HALF BUST		CROTCH	
☐ HALF WAIST		INSEAM	
☐ FRONT NECK TO WAIST		HALF KNEE	
BACK NECK TO WAIST		HALF ANKLE	
☐ BUST HEIGHT		OUTSEAM	
HALF BUST DISTANCE			
☐ HALF SHOULDER WIDTH			
SHOULDER TO NECK			
☐ ARM LENGTH			
☐ SLEEVE LENGTH			
☐ ARMHOLE CIRCUMFERENCE			
☐ NECKLINE CIRCUMFERENCE			
NECKLINE DEPTH			
☐ SKIRT LENGTH			
☐ HALF UPPER BUST			
HALF UNDER BUST			
☐ CUFF CIRCUMFERENCE			



Notes:

Fig. 2.1.17: Sample in-process inspection checklist

○ **Stitching checks**

Seam alignment, stitch density, seam strength, skipped stitches, and other sewing defects are examined using a stitch-per-inch (SPI) gauge, seam tester, and visual inspection checklist. The stitching defect rate is calculated using $(\text{Number of stitching defects} \div \text{Total garments inspected}) \times 100$, and the inspection reports are reviewed to identify recurring sewing defects and their root causes.

○ **Measurement checks**

Garment dimensions such as chest, waist, sleeve length, body length, and other critical measurements are verified using measuring tapes or templates against the approved measurement chart. Measurement deviation is calculated using $\text{Actual measurement} - \text{Specification measurement}$, while repeated deviations are analysed to identify production trends and determine whether corrective action is required.

- **Post-production inspection**

This stage assesses completed garments after manufacturing to verify compliance with customer specifications before packing and shipment.

Product ID		Product Name		Product Description				Product Standards / Specifications			
Audit Plan											
ID	Particulars	Size	Parameters				Method of Inspection	Standards ref.			
			Pa- 01	Tol + / -	Pa- 02	Tol + / -					
Measurement Results (Results tracks as per ID)											
ID	Sampling – 01 Results			Sampling – 02 Results			Observations Comments				
	Tolerance	Status	Details	Tolerance	Status	Details					
Remarks Comments Suggestions											
Product							Process				
Prepared by:										Approved by:	

Fig. 2.1.18: Post-production report template

- **AQL (acceptable quality limit) sampling**

Garments are selected according to the AQL sampling plan and inspected to determine whether the production lot meets the required quality standard. The inspection results are compared with the Acceptance number (Ac) and Rejection number (Re) in the AQL table, and defect data is classified by severity and defect type before making the acceptance decision.

- **Final quality verification**

Finished garments are checked for workmanship, measurements, appearance, labelling, packaging, and overall product quality using a final inspection checklist. The final defect rate is calculated using $(\text{Total defective garments} \div \text{Total garments inspected}) \times 100$, and the inspection report is analysed to identify defect patterns and recommend corrective measures before shipment.

- Continuous improvement

This stage analyses inspection findings and production performance to identify recurring quality issues and implement improvements for future manufacturing processes. Poka-yoke is a mistake-proofing technique that uses inspection findings to prevent recurring quality defects and support continuous improvement in future manufacturing processes.

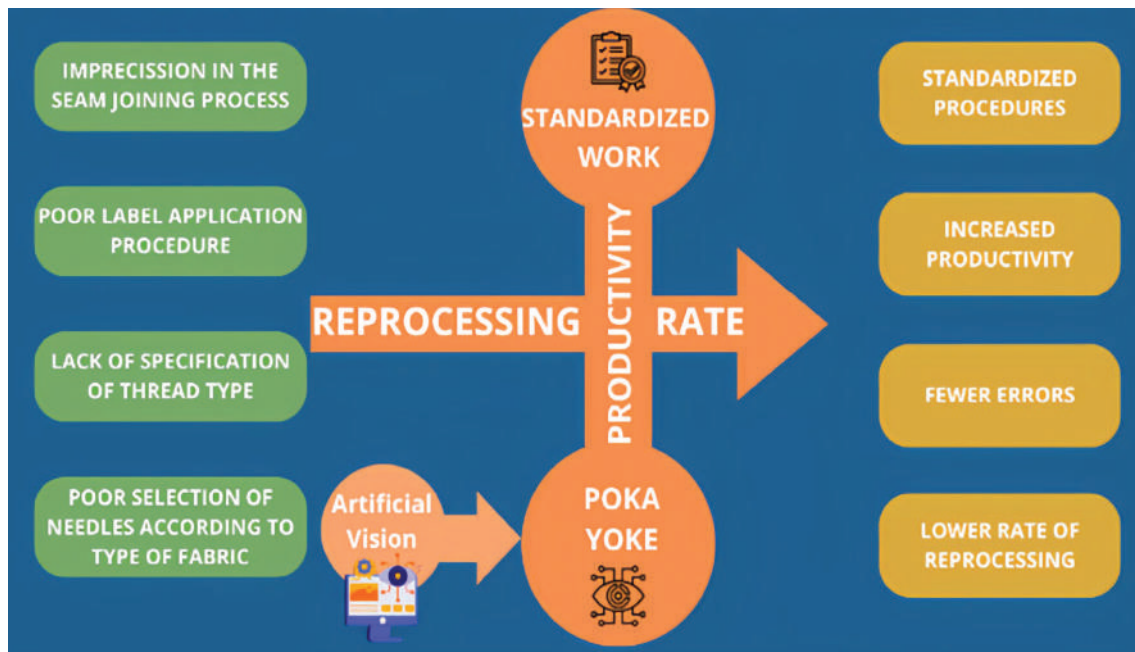


Fig. 2.1.19: Continuous improvement pillars (Poka yoke)

- **Feedback analysis**

Inspection reports, customer complaints, repair records, and production feedback are reviewed to identify recurring defects, their frequency, and the production stages where they occur. Analytical tools such as the Pareto chart, Fishbone diagram, and 5 Whys analysis are used to determine root causes and recommend suitable corrective and preventive actions.

- **Process optimisation**

Production reports from different batches, shifts, and production lines are compared to evaluate quality trends, process efficiency, and defect reduction over time. Key Performance Indicators (KPIs) such as Defect rate = $(\text{Total defects} \div \text{Total garments produced}) \times 100$, First pass yield (FPY), and Rework percentage are monitored to measure improvement and verify the effectiveness of corrective actions through continuous review.

UNIT 2.2: Quality Documentation and Inspection Practices

Unit Objectives

By the end of this unit, the participants will be able to:

1. Prepare visual defect charts, SOPs, and traceable quality records.
2. Discuss workplace inspection, repaired garment validation, and defect benchmarking against quality standards.

2.2.1 Visual Quality Documentation Systems

Visual quality documentation is the systematic practice of recording, standardising, and verifying garment defects to ensure rigorous production traceability and quality assurance consistency. It relies on executing photo documentation with timestamps, establishing standardised visual classification boards, and validating repaired apparel against precise resolution criteria to guarantee strict compliance. The following are the different components and systems of visual quality documentation:

- **Defect documentation process**

The defect documentation process involves recording garment defects to ensure defect traceability, supports root cause analysis, and provides evidence for quality improvement and compliance through the following components:

- **Photos**

High-resolution, timestamped digital photographs, including full-garment, close-up defect, and measurement-scale images, are captured to document the type, location, and severity of garment defects. These photographs ensure defect traceability, support root cause analysis, and serve as reference records for corrective actions.

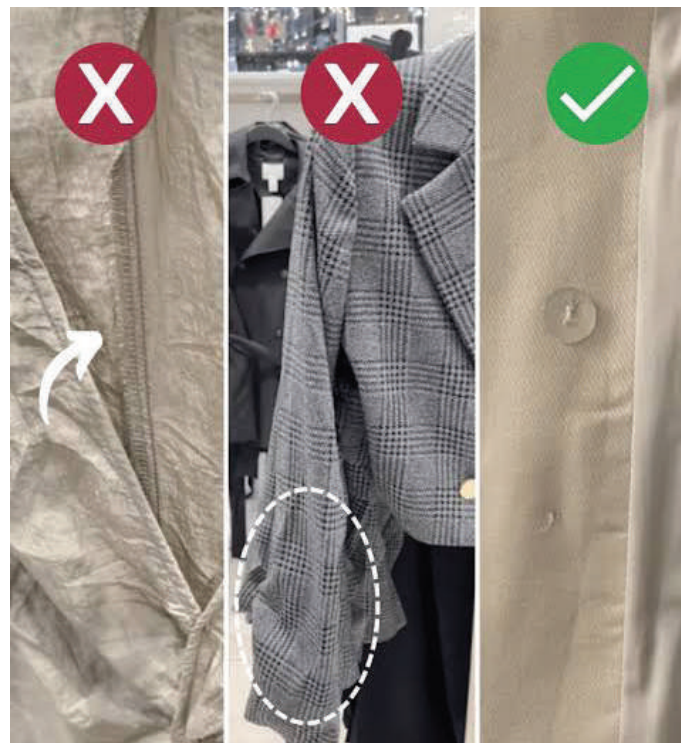


Fig. 2.2.1: Garment defect photograph

○ Time stamps

A date and time stamp are recorded when each defect is identified, inspected, repaired, or verified during production. This information helps track the sequence of events, monitor response time, and identify the production stage where the defect occurred.



Fig. 2.2.2: Time stamp sample

○ Corrective notes

Corrective notes document the identified defect, its probable cause, the corrective action taken, and the person responsible for resolving the issue. These records help verify that the defect has been addressed and provide valuable information for preventing similar defects in future production batches.

Action Plan

Prepared By: _____ (Name)

For the Period: _____

Objectives <i>(List of Team Objectives)</i>	Tasks <i>(what you need to do to achieve your objectives)</i>	Success Criteria <i>(How you can identify your success)</i>	Time Frame <i>(by when you need to achieve the tasks)</i>	Resources <i>(What Resources you need for each task)</i>

Fig. 2.2.3: Corrective note sample

- **Defect classification system**

The defect classification system organises garment defects according to their type, severity (critical, major, or minor), garment section, or production stage using standard defect codes and visual reference boards. It enables consistent defect reporting, simplifies quality analysis, and supports effective decision-making during inspection.

- **Visual defect classification boards**

Visual defect classification boards display standard images and descriptions of common garment defects, categorised by type and severity (critical, major, or minor). These boards help inspectors and production personnel identify, classify, and report defects consistently during quality inspections.

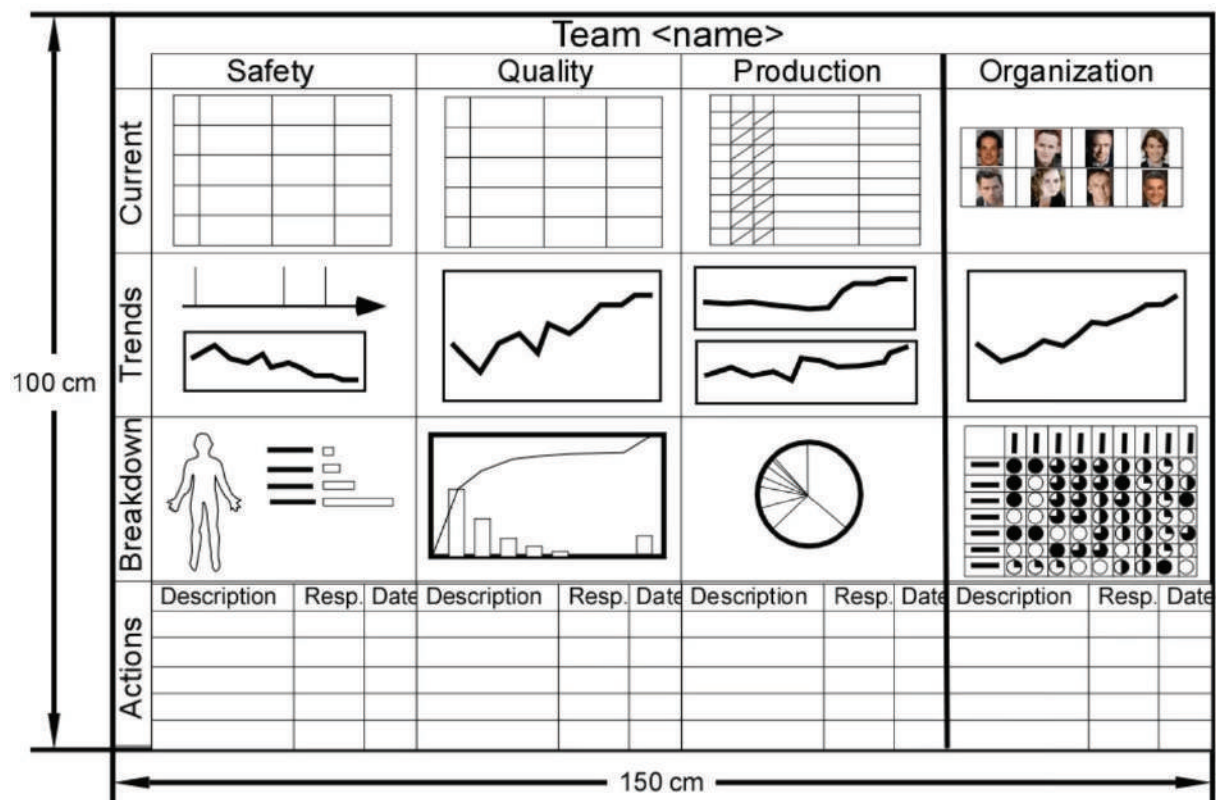


Fig. 2.2.4: Sample visual classification board

- **Standard operating procedure (SOPs)**

Standard operating procedures (SOPs) provide step-by-step instructions for garment inspection, defect reporting, and corrective actions to ensure consistent quality practices. They are prepared in accordance with the organisation's Quality Management System (QMS), Bureau of Indian Standards, Quality Council of India guidelines, and buyer specifications.

Supplier	batch	number			File	Part	Number
supplier					Production		
batch					inspection		
Adverse	number		Number of				
			defective				
Graphic:							

NO	Test items	Inspection standards	test result				date	test result			
Comprehensive			review					test			

Fig. 2.2.5: SOP sample template

- Repair verification process**

The repair verification process involves re-inspecting repaired garments to confirm that the identified defects have been completely corrected and that the garment complies with quality specifications. A repair verification checklist and acceptance criteria are used to ensure the garment meets customer and organisational quality standards before packing or shipment.

Date of Request: ____/____/____ Requesting Party: _____

Work Location: _____

Description of work/repair:

Requested Priority:

☐ High - Must be done within 24 hours.

☐ Medium - Within the week.

☐ Low – When you get a chance.

For Office Use Only:

Date Reviewed: ____/____/____ Priority Assigned: _____

Authorized By: _____

Comment:

Date Work Completed: ____/____/____ Number of Days to Complete: _____

Work Assigned To: _____

Fig. 2.2.6: Repair verification checklist

2.2.2 Inspection and Defect Benchmarking

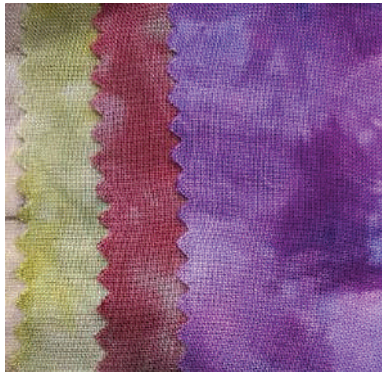
Inspection and defect benchmarking is the process by which an apparel quality analyst compares inspection findings and defect rates with organisational quality standards, buyer specifications, and previous production data. It helps assess quality performance, identify recurring defects, and recommend corrective actions to improve product quality and consistency.

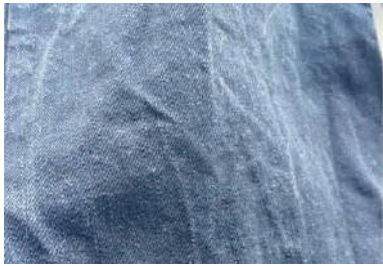
What is fabric defect correlation?

Fabric defect correlation is the process of linking fabric-related issues with the garment defects observed during quality inspection. It helps identify the root causes of defects, enabling corrective actions to improve product quality and reduce defect recurrence.

Types of fabric defects:

A fabric defect is any flaw, irregularity, or imperfection in the fabric that affects its appearance, performance, or suitability for garment manufacturing, such as follows:

Fabric defect	Description	Image
Shade variation	Shade variation is a difference in fabric colour within the same roll or between different fabric lots.	
Hole or tear	Hole or tear is damage to the fabric that creates openings or cuts, reducing its strength and appearance.	
Slub	Slub is a thick or uneven section in the yarn that creates an irregular fabric surface.	

Fabric defect	Description	Image
Oil or grease stain	Oil or grease stain is a fabric defect caused by oil or lubricant contamination during manufacturing or handling.	
Broken ends or picks	Broken ends or picks are weaving defects caused by broken warp or weft yarns, creating visible gaps in the fabric.	
Uneven fabric width	Uneven fabric width is a defect in which the fabric width varies beyond the specified tolerance.	
Pilling	Pilling is the formation of small fibre balls on the fabric surface due to rubbing during use or washing.	
Crease marks	Crease marks are permanent folds or wrinkles formed on the fabric during processing or storage.	

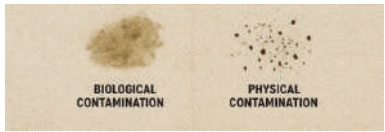
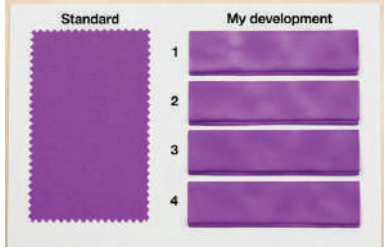
Fabric defect	Description	Image
Bowing or skewing	Bowing or skewing is the distortion of yarns that causes fabric patterns or stripes to appear curved or slanted.	
Contamination	Contamination is the presence of dirt, foreign fibres, stains, or other unwanted particles on the fabric.	
Fabric shrinkage	Fabric shrinkage is the reduction in fabric dimensions after washing, steaming, or finishing.	
GSM variation	GSM variation is a difference between the actual and specified fabric weight per square metre.	

Table 2.2.1: Common fabric defects and identification guide

A fishbone diagram helps identify and organise the possible root causes of fabric-related and garment defects, making it easier to determine the actual source of quality problems.

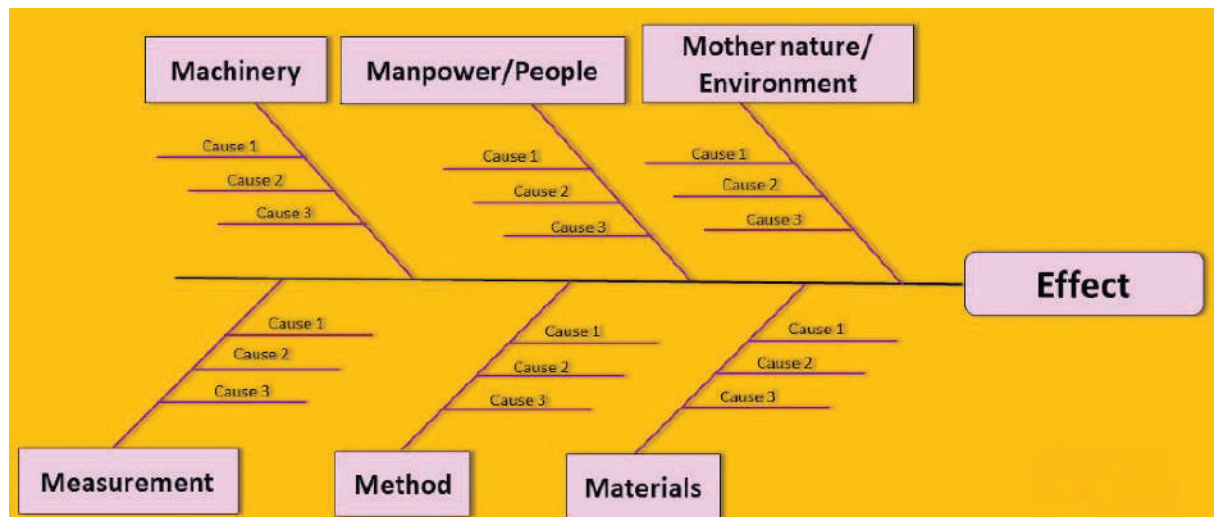


Fig. 2.2.7: RCA analysis of fabric defects

Defect impact evaluation

Defect impact evaluation is the process of assessing how garment defects affect its appearance, functionality, and overall quality. It helps determine the impact of defects on customer satisfaction and supports decisions on corrective actions and product acceptance.

- Garment aesthetics**

Garment aesthetics refers to the visual appeal of a garment, including its colour, shape, fit, finish, symmetry, and overall appearance. The following are the parameters and the stages for the defect impact evaluation:

Garment aesthetics parameter	Identifying points	Defect evaluation test	Evaluation procedure	Outcome
Colour	Shade consistency, colour match, stains, fading	Shade card or light box comparison	Compares the garment with the approved shade under standard lighting.	Uniform colour is accepted; shade variation or stains require rework or rejection.
Shape	Silhouette, panel alignment, distortion	Visual comparison with the approved sample	Compares the garment shape with the approved sample on a flat table or mannequin.	Correct shape is accepted; distortion requires correction.
Fit	Dimensions, balance, drape	Measurement against specification chart (e.g., ± 1 cm tolerance)	Measures specified points and compares them with the measurement chart.	Measurements within tolerance are accepted; deviations require alteration or rejection.

Garment aesthetics parameter	Identifying points	Defect evaluation test	Evaluation procedure	Outcome
Finish	Loose threads, stains, wrinkles, pressing quality, cleanliness	Visual inspection checklist	Inspects the garment under standard lighting against finishing standards.	A clean finish is accepted; finishing defects require rework.
Symmetry	Collar, sleeves, pockets, hems, left-right balance	Fold test or visual alignment	Folds the garment or visually compares both sides for alignment.	Proper symmetry is accepted; imbalance requires correction.
Overall appearance	Colour, shape, fit, finish, symmetry	Final visual inspection against the approved sample	Performs a final visual inspection against buyer and organisational standards.	Garments meeting all standards are approved; visible defects require rework or rejection.

Table 2.2.2: Garment aesthetics evaluation

- Garment functionality**

Garment functionality refers to how well a garment performs its intended purpose, including its fit, comfort, durability, and ease of use. Garment functionality is evaluated using a combination of standard specifications, physical tests, and functional checks, depending on the garment type and buyer requirements:

Functionality parameter	Standard methodology
Fit	Measurement specification chart, measuring tape, fit mannequin or live fit model
Comfort	Wear trial, hand feel assessment, fabric performance test
Durability	Tensile strength test, seam strength test, abrasion test, wash test
Ease of use	Functional check of zippers, buttons, snaps, Velcro, drawstrings, elastic, etc.
Stretch and recovery (if applicable)	Stretch and recovery test
Pocket functionality	Pocket dimension and usability check
Fastener performance	Zip cycling test, button pull test, snap fastening test

Table 2.2.3: Garment functionality evaluation

- **Customer satisfaction**

Customer satisfaction refers to the extent to which a garment meets or exceeds customer expectations for quality, appearance, fit, comfort, and performance.

Customer satisfaction KPI	What it measures	How it is measured	Target / Outcome	Customer satisfaction KPI
Customer satisfaction score (CSAT)	Overall customer satisfaction with quality, appearance, fit, comfort, and performance	Customer feedback survey (e.g., 1–5 rating)	A higher score indicates greater customer satisfaction.	Customer satisfaction score (CSAT)
Product return & complaint rate	Returns and complaints due to quality, fit, or defects	$(\text{Returns or complaints} \div \text{Total garments sold}) \times 100$	A lower rate indicates better product quality and customer acceptance.	Product return & complaint rate
Quality acceptance rate	Percentage of garments accepted without issues	$(\text{Accepted garments} \div \text{Total garments sold}) \times 100$	A higher acceptance rate reflects consistent garment quality.	Quality acceptance rate
Repeat purchase & review rating	Customer loyalty and overall product experience	Repeat purchase percentage and average product rating	Higher repeat purchases and ratings indicate greater customer satisfaction.	Repeat purchase & review rating

Table 2.2.4: Garment aesthetics evaluation

Defect rate benchmarking

Defect rate benchmarking is the process of comparing garment defect rates with industry standards, buyer requirements, or past production data. It helps assess quality performance, identify gaps, and implement corrective actions to reduce defects. Defect rate benchmarking is done in the following stages:

Defect rate	Description	Industry benchmark	Interpretation	Validation of repaired garments
Critical defect rate	Percentage of garments with safety or usability defects.	0%	A higher rate is unacceptable; 0% indicates full compliance.	Verify all critical defects are eliminated before approval.
Major & minor defect rate	Percentage of garments with appearance, fit, functionality, or workmanship defects.	Major: ≤ 2–3% Minor: ≤ 5%	Lower rates indicate better process control and product quality.	Confirm repaired defects meet buyer specifications and quality standards.

Defect rate	Description	Industry benchmark	Interpretation	Validation of repaired garments
Overall defect rate (DHU)	Total defects found per 100 garments inspected.	≤ 5 DHU.	Lower DHU indicates better overall manufacturing quality.	Re-inspect garments to ensure overall defects are reduced.
First pass yield (FPY)	Percentage of garments passing inspection without rework.	$\geq 95\%$	Higher FPY indicates an efficient and capable production process.	Confirm repaired garments pass inspection on the first re-inspection.
Quality loss rate	Percentage of garments requiring rework, rejection, or customer returns.	Rework: $\leq 3\%$ Rejection: $\leq 1-2\%$ Returns: $\leq 1\%$	Lower rates indicate fewer quality failures and higher customer satisfaction.	Ensure repaired garments meet acceptance criteria before shipment.

Table 2.2.5: Key garment defect benchmarks

Summary



- Garment defects are faults that affect the appearance, fit, performance, or quality of a garment.
- Common garment defects can arise from fabric faults, incorrect stitching, poor cutting, improper handling, or machine problems.
- Garment defects are classified as major or minor based on their type, severity, frequency, and quality standards.
- Identifying defects at an early stage helps reduce rework, wastage, and production costs.
- Quality inspection is carried out throughout the garment production process to ensure product conformity.
- Inspection reports and defect records help identify recurring defects, production trends, and quality issues.
- Defect analysis supports the identification of root causes and improves manufacturing processes.
- Visual defect charts and Standard Operating Procedures (SOPs) promote consistent defect identification and quality inspection.
- Traceable quality records, including photographs and timestamps, improve documentation and accountability.
- Repaired garments must be validated to ensure that defects have been completely corrected.
- Defect benchmarking helps organisations compare quality performance with internal targets and industry standards.
- Effective documentation and inspection practices improve product quality, customer satisfaction, and continuous quality improvement.

Exercise

Multiple-choice Question:

1. How are garment defects generally classified?
 - a. By garment colour
 - b. By production shift
 - c. By type, severity, frequency, and quality standards
 - d. By garment price

2. Why are inspection reports maintained during garment production?
 - a. To increase production time
 - b. To identify defect trends and improve quality
 - c. To record employee attendance
 - d. To calculate worker salaries

3. What is the purpose of a visual defect classification chart?
 - a. To advertise garments
 - b. To standardise defect identification and inspection
 - c. To monitor employee attendance
 - d. To record sales data

4. What should be done after a garment has been repaired?
 - a. Pack it immediately
 - b. Validate the repair to ensure the defect is corrected
 - c. Send it to the customer without inspection
 - d. Discard the garment

5. Why is defect benchmarking important?
 - a. To increase production costs
 - b. To compare quality performance with standards
 - c. To reduce the number of workers
 - d. To improve garment packaging

Descriptive Questions:

1. Explain the classification of garment defects into major and minor defects.
2. Describe the relationship between the garment production process and the occurrence of defects.
3. Explain the importance of inspection reports and defect analysis in quality improvement.
4. Describe the role of visual defect charts, SOPs, and traceable quality records in apparel quality management.
5. Explain the importance of workplace inspection, repaired garment validation, and defect benchmarking in maintaining garment quality.

Notes

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/WTIFD2MQdbM>

Garment and fabric defects



3. Analyse Data and Prepare Quality Insights Reports

Unit 3.1 - Production Quality Control Processes

Unit 3.2 - Quality Documentation and Records



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Explain the organisational hierarchy and the core steps involved in monitoring quality across various stages of production.
2. Describe how to inspect raw materials, fabrics, patterns, and templates to ensure they meet specified quality standards before cutting.
3. Outline the process for checking machine settings and attachments to align them with required production standards.
4. Prepare control charts to track and maintain quality insights effectively.
5. Analyse critical details within production and inspection documents, including trim cards, measurement charts, and sample types.
6. Complete and maintain all necessary documentation related to production and quality inspection workflows.

UNIT 3.1: Production Quality Control Processes

Unit Objectives

By the end of this unit, the participants will be able to:

1. Elaborate on production quality monitoring methods used to evaluate garment quality, identify defects, and maintain compliance with quality standards.
2. Describe the procedures for inspecting raw materials to verify their quality, specifications, and suitability for garment production.
3. Explain the process of pattern and template verification to ensure dimensional accuracy, design conformity, and production consistency.
4. Elucidate the importance of machine setting verification in maintaining process accuracy, minimising defects, and achieving consistent garment quality.

3.1.1 Production Quality Monitoring

Production quality monitoring is the process of continuously tracking garment quality during production to identify defects and process variations. It helps ensure compliance with quality standards, enables timely corrective actions, and maintains consistent product quality. The monitoring is done using several documents where production records are maintained.

What are the different documents used in production quality monitoring?

Production and inspection documents are records used to monitor production activities, production results, defects, and corrective actions throughout the manufacturing process. Maintaining these documents ensures traceability, quality control, and compliance with organisational and buyer requirements.

- **Production order**

A production order specifies the garment style, quantity, size, colour, delivery schedule, and production requirements. The apparel quality analyst verifies that it is updated with approved revisions and used as the reference throughout production.

Priority Level		Order Date and Time	
Date Needed		Date Delivered	
Work Assigned To		Work Billed To	

Request Description		Company Name 123 Company Address Drive Fourth Floor, Suite 412 Company City, NY 11101 321-654-9870 email address		YOUR LOGO	
		WORK ORDER			
		Requester Name		Location Address	
		Phone			
		Email			
		Priority Level		Order Date and Time	
Date Needed		Date Delivered			
Work Assigned To		Work Billed To			
Request Description					
Description of Work Completed		Description of Work Completed			

Fig. 3.1.1: Production order

- **Cutting report**

A cutting report records fabric cutting details, quantities, and cutting output. The apparel quality analyst maintains it by verifying cutting records, identifying cutting defects, and updating inspection findings.

Hours	Total pieces checked	Total pieces accepted
H- I	20	19
H- II	32	30
H- III	25	21
H- IV	30	28
H- V	25	24
H- VI	22	18
H- VII	26	24
H- VIII	30	29
Ot hours	56	58
Total	266	246

Fig. 3.1.2: Apparel cutting report sample sheet

- **Bundle tracking sheet**

A bundle tracking sheet records the movement of garment bundles through each production stage. The apparel quality analyst updates and verifies the sheet to ensure complete traceability of every bundle.

[illegible]

Fig. 3.1.3: Bundle tracking sheet

- **Line production report**

A line production report records production output, efficiency, and quality performance. The apparel quality analyst maintains it by recording inspection results, defect trends, and production quality data.

[illegible]

Total Scrap Qty / Unit Weight

Supervisor Note:

Fig. 3.1.4: ine production report

- **Machine maintenance record**

A machine maintenance record documents machine servicing, repairs, and preventive maintenance activities. The apparel quality analyst verifies maintenance records to ensure machines are suitable for quality production.

MANUFACTURER INFORMATION					
Manufacturer:					
Address:					
Phone Number:					
Email:					

MAINTENANCE ACTIVITY					
Date	Maintenance Type	Performed By	Description of Maintenance	Cost	Next Maintenance Due

ADDITIONAL NOTES	
Date	Note

Fig. 3.1.5: Machine maintenance record sheet

- **Production planning sheet**

A production planning sheet records production schedules, targets, and resource allocation. The apparel quality analyst updates it with quality-related observations and verifies that production follows the planned schedule.

Project	Resource Type	Effort	Week 1	Week 2	Week 3	Week 4

Fig. 3.1.6: Production planning sheet

3.1.2 Raw Material Inspection

Raw material inspection is the process of examining fabrics, trims, and accessories to verify that they meet specified quality standards before production. It helps identify defects early, prevent quality issues during manufacturing, and ensure consistent garment quality.

Reference standards to inspect raw materials:

The Fabric Inspection Checklist and Raw Material Inspection Checklist serve as the standard reference documents used by an apparel quality analyst to inspect raw materials, identify defects, and verify compliance with quality specifications before production.

- **Fabric defects overview**

Fabric is the primary raw material used to manufacture garments and is inspected for defects through physical inspection and fabric inspection checklist. Through physical inspection, defects such as shade variation, holes, slubs, stains, bowing, skewing, and shrinkage can be studied (refer to sections 2.1.1, 2.1.4, and 2.2.2). For defects such as GSM variation, width, construction, and apparel quality, the analyst checks these defects against approved specifications using physical inspection and a fabric inspection checklist. It helps the apparel quality analyst systematically identify fabric defects, verify compliance with specifications, and record inspection results consistently.

Textile Eng.		FABRIC ANALYSIS	
Date:		Fabric Type:	
Name:			
YARN RAW MATERIAL		Warp	
		Weft	
Yarn	TYPE		Warp
			Weft
	COUNT		Warp
			Weft
	TM and direction		Warp
			Weft
	OTHER		Warp
			Weft
Fabric	DENSITY (cm)	Greige	Warp ± 3
			Weft ± 3
		Finished	Warp ± 5
			Weft ± 10
	CRIMP (%)	Greige	Warp
			Weft
		Finished	Warp
			Weft
	G/M ²	Greige	Warp
			Weft
		Finished	Warp
			Weft
	Measured	Total	
		LENGTH OF WARP in 100 m of finished fabric	
	GREIGE FABRIC LENGTH (for a finished length of 100 m)		Finished
	WEAVE DESIGN		
	REED	NO	
		ENDS/DENT	
	WIDTH (cm)	Reed	
		Greige	
Finished			
NUMBER OF ENDS	Ends (base)		
	Selvage		
	Total Ends		
Finishing			
WEAVING MACHINE SELECTION			
COVER FACTOR	1		

Fig. 3.1.7: Fabric analysis sheet

The following are the key fabric inspection parameters used to evaluate fabrics:

- **GSM variation**

GSM variation is the difference between the actual and specified fabric weight per square metre. The apparel quality analyst measures the GSM using a GSM cutter and weighing balance, compares it with the fabric inspection checklist, and evaluates woven, knitted, denim, printed and dyed, and silk and specialty fabrics for compliance.

- **Width**

Width is the difference between the actual and specified fabric width. The apparel quality analyst measures the fabric width at multiple locations, compares it with the fabric inspection checklist, and evaluates woven, knitted, denim, printed and dyed, and silk and specialty fabrics for compliance.

- **Construction**

Construction refers to the fabric structure, including the weave or knit pattern, yarn count, and thread density. The apparel quality analyst examines the construction visually or with a pick glass, compares it with the fabric inspection checklist, and evaluates woven, knitted, denim, printed and dyed, and silk and specialty fabrics for compliance.

- **Appearance**

Appearance refers to the overall visual quality of the fabric, including shade, stains, holes, slubs, print quality, bowing, skewing, wrinkles, and finish. The apparel quality analyst performs a visual inspection using a fabric inspection machine or inspection table, records defects in the fabric inspection checklist, and evaluates woven, knitted, denim, printed and dyed, and silk and specialty fabrics for compliance.

- **Raw material inspection checklist**

A raw material inspection checklist is a standard quality document that includes inspection parameters for trims and accessories such as threads, buttons, zippers, labels, elastics, interlinings, and packaging materials. It helps the apparel quality analyst inspect raw materials for defects, ensure compliance with approved specifications, and maintain consistent quality before production.

Sr. No.	PO # & Date	Material Receive Date	Material Name	Type of Material	Nos. Received (UoM)	Inspection Type	Inspection Conducted / Description	Date of inspection	Inspection Conducted by
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									

Fig. 3.1.8: Raw material inspection sheet

The following are the key non-fabric raw materials and their inspection parameters used to evaluate trims and accessories:

- **Sewing threads**

Sewing threads are used to stitch garment components together and may have defects such as uneven thickness, low tensile strength, shade variation, or knots. The apparel quality analyst inspects thread count, strength, colour, uniformity, and elongation against approved standards before production.

- **Buttons**

Buttons are fastening accessories that may have defects such as cracks, scratches, colour variation, size variation, or poor finish. The apparel quality analyst checks button size, colour, appearance, finish, strength, and attachment holes against approved samples and specifications.

- **Zippers**

Zippers are fastening components that may have defects such as broken teeth, slider damage, misalignment, or poor operation. The apparel quality analyst verifies zipper length, smooth operation, strength, colour, and alignment against buyer specifications.

- **Labels and tags**

Labels and tags provide product identification and care information and may have defects such as incorrect printing, spelling errors, poor stitching, or wrong dimensions. The apparel quality analyst checks print accuracy, size, colour, placement, and readability against approved artwork and specifications.

- **Elastics**

Elastics provide stretch and recovery in garments and may have defects such as poor elasticity, uneven width, or damaged edges. The apparel quality analyst evaluates elasticity, recovery, width, appearance, and strength against approved quality standards.

- **Interlining**

Interlining provides shape and support to garment components and may have defects such as poor bonding, uneven thickness, wrinkles, or delamination. The apparel quality analyst checks bonding strength, thickness, shrinkage, and appearance against approved specifications.

- **Packaging materials**

Packaging materials include polybags, cartons, tissue paper, and hangers, which may have defects such as tears, incorrect printing, poor dimensions, or contamination. The apparel quality analyst verifies size, print quality, material strength, cleanliness, and labelling against buyer requirements before packing.

3.1.3 Pattern and Template Verification

Pattern and template verification is the process of checking the accuracy of garment patterns and templates before fabric cutting. The apparel quality analyst verifies dimensions, shape, alignment, and specifications against approved patterns to prevent cutting errors and ensure garment quality. The following are the key pattern and template accuracy parameters used to verify garment patterns before fabric cutting:

- **Pattern dimensions and measurements**

Pattern dimensions define the length, width, curves, and size measurements required for garment components. The apparel quality analyst inspects key measurement points using a measuring scale and compares them with the approved measurement chart to ensure accuracy before cutting.

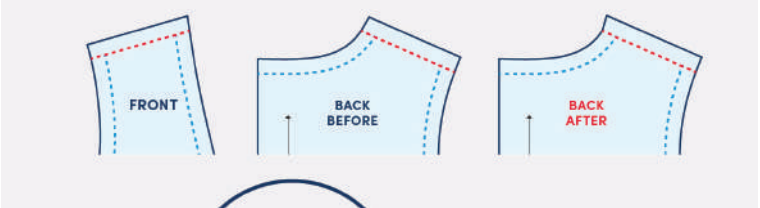
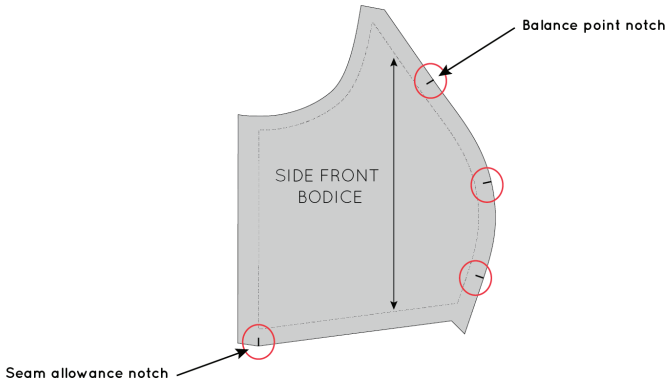
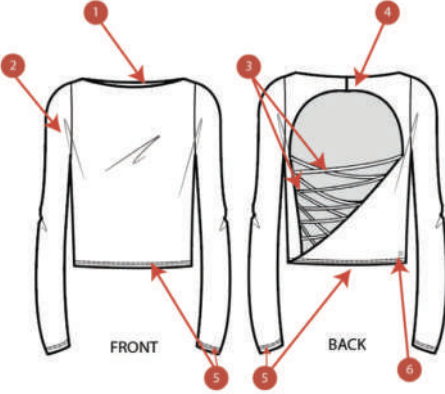
BODY	LENGTH	FULL BODY WIDTH
XS	27"	34"
S	28"	38"
M	29"	41"
L	30"	44"
XL	31"	48"
2XL	32"	52"
3XL	33"	56"
4XL	34"	60"

Fig. 3.1.9: Apparel pattern dimension

- Pattern shape and construction details**

Pattern shape and construction details include garment silhouette, seam allowances, notches, markings, and component alignment. The apparel quality analyst verifies the pattern shape, seam margins, and reference markings against approved patterns to ensure correct assembly during stitching.

Pattern shape and construction parameters	Images
Silhouette	

Pattern shape and construction parameters	Images
Seam allowances	
Notches	
Markings	
Component alignment	

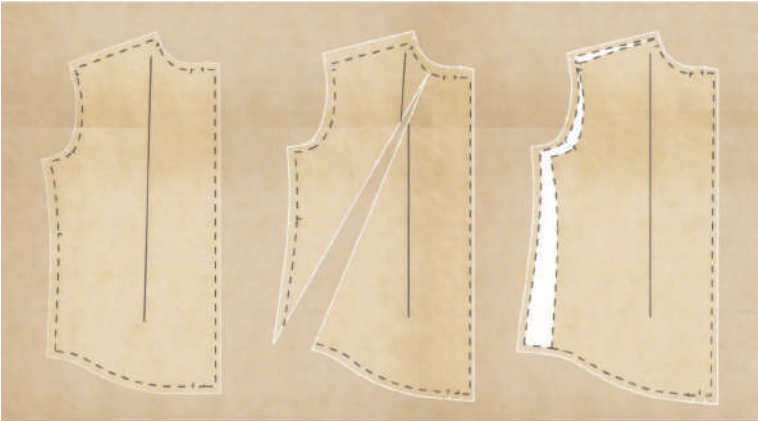
Pattern shape and construction parameters	Images
Seam allowance Reference markings	

Table 3.1.1: Pattern shape and construction

- **Grain line and fabric placement**

Grain line indicates the correct fabric direction for placing pattern pieces during cutting to maintain garment drape and appearance. The apparel quality analyst checks grain line accuracy and alignment on each pattern piece to prevent distortion and fabric wastage.

- **Pattern symmetry and matching**

Pattern symmetry ensures that corresponding garment components, such as left and right panels, are balanced and identical. The apparel quality analyst compares matching pattern pieces to verify equal dimensions, alignment, and fitting accuracy.

- **Template and grading accuracy**

Template and grading accuracy ensure that cutting templates and size variations maintain the required garment shape and proportions. The apparel quality analyst verifies template dimensions and graded sizes against approved patterns and size charts before fabric cutting.

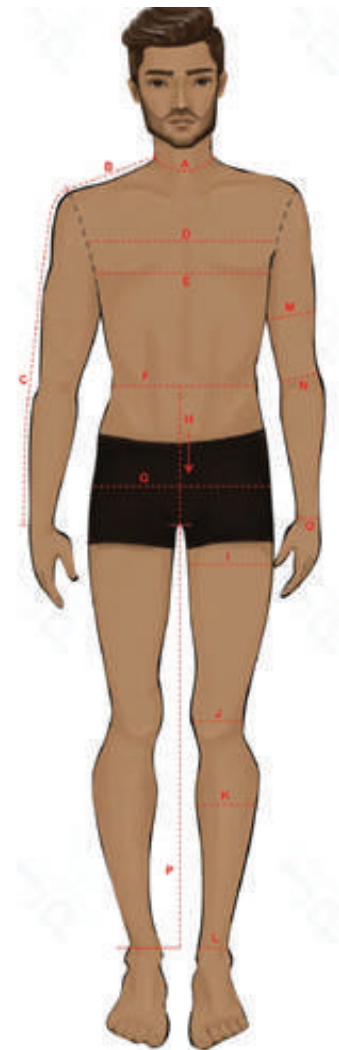
Documents needed for pattern and template verification

The apparel quality analyst uses pattern measurement sheets, approved sample patterns, pattern checklists, measuring scales, and template verification checklists to verify dimensions, shape, alignment, and specifications before fabric cutting such as follows:

- **Pattern measurement sheets**

Pattern measurement sheets provide approved dimensions for garment components. The apparel quality analyst verifies pattern length, width, curves, and size measurements against specifications before cutting.

Name	Date
Height	Size Number
A	Neck circumference: at base of neck
B	Shoulder length: from *HPS to tip of shoulder bone
C	Arm length: from tip of shoulder bone to wrist
D	Across front: Straight between armholes / 5" from HPS
E	Chest circumference: around chest at widest point
F	Waist circumference: at narrowest part of waist
G	Hip circumference: at widest part of hips / seat
H	Total rise: from CF waist to CB waist through crotch area
I	Thigh
J	Knee
K	Calf
L	Ankle
M	Bicep
N	Elbow
O	Wrist
P	Inseam to ankle
Q	Inseam to floor
R	Neck to waist
S	Neck to floor
T	Waist to floor
U	Total height: from the top of the head to the floor



*HPS (High Point Shoulder) = The point is

Fig. 3.1.10: Pattern measurement chart sample

- **Approved pattern checklists**

Approved pattern checklists define the authorised garment shape, dimensions, markings, grain line, and alignment, while providing inspection checkpoints for verification. The apparel quality analyst uses them to ensure pattern accuracy, completeness, symmetry, and fit before production.

Sample Type:	☐ Shipping Sample	☐ TOP/PS Sample	☐ Shipment Reference Sample
	☐ Approval Sample		
Styling Report :	See styling check report		
Wash Comments :			
	☐ Hand Feel	☐ Shade	
Measurement Report :	see measurement check report		

Trims & Accessories Check List									
Thread		Price tag		Poly		Sequin			
Button		Security Tag		Poly Sticker		PU			
Snap		Care Label		Folding		Dry Process			
Velcro		Caution Label		Tissue		Rips			
Zipper		Main Label		Card Board		Shoulder Tape			
Revert		Size Label		Silica		Shoulder Pad			
Jackron		Others Label		Super Dry		Hanger loop			
Eyelet		Printed Main Label				Buckle			
Hook & Eye		Waist Tag							
Draw string		Styling Hang Tag							
Interlining		Hang Tag							
Pocketing		Print							
		Price Sticker							
Fabric Composition									
Comments:									
Sample Handover To:									
Name:		Designation:		Signature:					
Handover Date:									

Fig. 3.1.11: Approved pattern checklists

- **Template verification checklists**

Template verification checklists define approved template dimensions, grading, markings, seam allowances, and measurement requirements for inspection. The apparel quality analyst uses them with measuring scales to verify template accuracy against approved patterns and size charts before fabric cutting.

FABRIC:							
HOUSEKEEPING IN THE FABRIC WAREHOUSE					SCORE:	/ 5	
1	FABRIC ON PALETTE / SHELF / RACK	☐ NO	☐ YES	☐ PARTLY			
2	FABRIC ROLL IN PLASTIC BAG / COVER	☐ NO	☐ YES	☐ PARTLY			
3	LOCATION SYSTEM FOR FABRIC STORAGE	☐ NO	☐ YES	☐ PARTLY			
4	STOCK KEEPING RECORDS	☐ NO	☐ YES	☐ PARTLY			
5	IS THERE STOCK ROTATION MANAGEMENT BY DATE?	☐ NO	☐ YES	☐ PARTLY			
6	IF YES THEN HOW?						
7	DIRECT SUNLIGHT SHINING ON FABRIC	☐ NO	☐ YES	☐ PARTLY			
8	CLEANLINESS	☐ UNACCEPTABLE	☐ IMPROVEMENT NEEDED	☐ ACCEPTABLE			
9	TIDINESS	☐ UNACCEPTABLE	☐ IMPROVEMENT NEEDED	☐ ACCEPTABLE			
10	VENTILATION SYSTEM	☐ UNACCEPTABLE	☐ IMPROVEMENT NEEDED	☐ ACCEPTABLE			
COLOR ASSESSMENT:						SCORE:	/ 5
1	IS THERE ANY LIGHT BOX IN THE AREA?	☐ NO	☐ YES	MODEL OF LIGHT BOX:			
2	IS THERE A CALIBRATION REPORT FROM 3 RD PARTY?	☐ NO	☐ YES				
3	IS FACTORY AWARE OF THEIR CUSTOMER'S LIGHTING POLICY?	☐ NO	☐ YES				

4	AVAILABILITY OF THE COLOR STANDARD		☐ NO	☐ YES
5	IS THE LIGHT BOX IN A DARK ROOM?		☐ NO	☐ YES ☐ PARTLY
6	HOW DOES THE FACTORY USES THE LIGHT BOX?			
7	ARE RECORDS KEPT FOR EACH DYELOT?		☐ NO	☐ YES ☐ PARTLY

TESTING:			SCORE:	/ 10
1	DOES THE FACTORY HAVE IN-HOUSE LAB?		☐ NO	☐ YES
2	IF YES, ACCREDITED BY:	ACCREDITATION VALID TO:		
WHAT TEST ARE DONE IN THE IN-HOUSE LABORATORY?				
3	☐ COLOR FASTNESS	☐ SHRINKAGE	☐ DURABILITY	
	☐ WEIGHT CHECK	☐ SEAM TWISTING	☐ CROCKING	
	OTHERS, PLEASE SPECIFY:			

Fig. 3.1.12: Template verification checklist

3.1.4 Machine Setting Verification

What is machine setting verification?

Machine setting verification ensures sewing machine parameters such as stitch length, thread tension, needle type, and presser foot pressure conform to approved specifications to prevent stitching defects and maintain consistent garment quality.

Brand: _____		Model: _____	
DATE	Professionally Cleaned	Cleaned	Oiled

Notes _____

Fig. 3.1.13: Machine setting verification checklist

What are the different machines used in production?

Production machines are equipment used in garment manufacturing processes such as cutting, stitching, finishing, and quality enhancement. The apparel quality analyst verifies machine suitability, settings, and performance to ensure defect-free production. The following are the different types of machines used in apparel production:

- **Cutting machines**

Cutting machines are used to cut fabric layers into garment components as per approved patterns. The apparel quality analyst verifies blade condition, cutting accuracy, alignment, and machine settings to prevent cutting defects.



Fig. 3.1.14: Apparel cutting machine

- **Sewing machines**

Sewing machines are used to join garment components through different stitch types. The apparel quality analyst checks stitch quality, thread tension, stitch length, needle condition, and machine settings to ensure consistent stitching.



Fig. 3.1.15: Industrial sewing machine

- **Overlock machines**

Overlock machines are used for seam finishing and edge protection to prevent fabric fraying. The apparel quality analyst verifies stitch formation, thread tension, trimming quality, and seam strength.



Fig. 3.1.16: Overlock machine

- **Flatlock machines**

Flatlock machines are used to create flat seams, commonly used in knitwear and sportswear. The apparel quality analyst checks seam appearance, stitch balance, thread tension, and machine settings for quality compliance.



Fig. 3.1.17: Flatlock machine

- **Button attaching machines**

Button attaching machines are used to securely attach buttons to garments. The apparel quality analyst verifies button placement, attachment strength, stitch formation, and machine alignment.



Fig. 3.1.18: Button attaching machine

- **Buttonhole machines**

Buttonhole machines are used to create buttonholes of required size and shape. The apparel quality analyst checks buttonhole dimensions, cutting accuracy, stitch density, and placement.



Fig. 3.1.19: Buttonhole machine

- **Zipper attaching machines**

Zipper attaching machines are used to attach zippers accurately to garments. The apparel quality analyst verifies zipper alignment, stitch quality, seam strength, and machine settings.

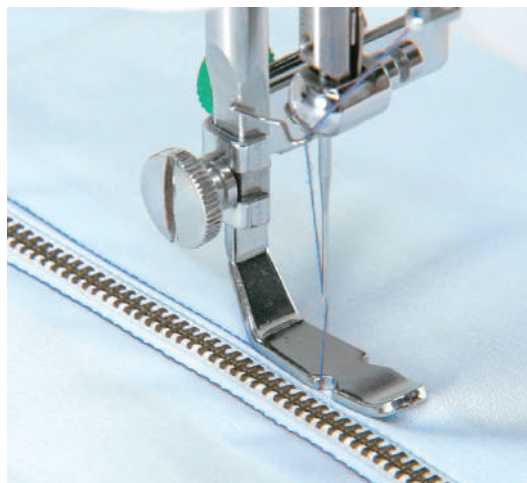


Fig. 3.1.20: Zipper attaching machine

- **Pressing and finishing machines**

Pressing and finishing machines are used for garment shaping, wrinkle removal, and final appearance enhancement. The apparel quality analyst checks temperature, pressure, steam settings, and finishing quality.



Fig. 3.1.21: Pressing and finishing machine

- **Inspection machines**

Inspection machines are used to examine fabrics and finished garments for defects. The apparel quality analyst verifies lighting, inspection speed, and defect detection accuracy to maintain quality standards.



Fig. 3.1.22: Apparel inspection machine

What is meant by production standard?

Production standards are approved guidelines that define the required machine settings, attachments, operating conditions, and quality parameters for garment manufacturing processes. The apparel quality analyst uses these standards to verify machine setup, ensure correct attachments are used, and maintain consistent production quality.

Machine setting check as per production standard

Machine setting check, as per production standard, is the process of verifying machine parameters such as stitch length, thread tension, needle type, presser foot pressure, and attachments against approved production standards. The apparel quality analyst performs these checks before production to ensure correct machine operation, prevent defects, and maintain consistent garment quality. The following are the different types of production standards that are used to check machine settings:

- **Fabric spreading & cutting SOP**

Fabric spreading & cutting SOP defines the required machine setup parameters, including blade condition, fabric alignment, spreading accuracy, and cutting settings. The apparel quality analyst verifies these parameters against the SOP to ensure accurate cutting and prevent fabric defects.

Steps	Notes	Completed
Select Fabric		
Select Pattern		
Prepare Fabric		
Notions and Supplies		
Sewing Machine Needle		
Thread		
Layout		
Cutting		
Marking		
Stitching/Pressing		
Final Touches		

Fig. 3.1.23: Fabric cutting and setting SOP template

- **Needle broken policy SOP**

Needle broken policy SOP defines the requirements for needle condition, replacement procedures, stitch quality, and machine safety settings. The apparel quality analyst verifies needle status, stitch parameters, and compliance with the SOP to prevent stitching defects.

Type of Needle	Type of Machine	Daily Broken Needle Qu:	
		1	2
DC x 27	Overlock		
DB x 1	Vertical Stitch		
DP x 5	Plane Machine 2 Needle, ZigZag		
UY x 128	Chain Stitch, Flatlock, F/A		
UO x 113	Kansai		
DP x 17	Bar tack		
DO x 558	Eyelet Button Hole		
TV x 5	Flatlock, F/A		
LW x 6T	Blind Stitch		
TV x 64	Feed of the arm machine		

Quality In Charge

Compliance Executive

Maintenance Manager

Fig. 3.1.24: Broken needle record SOP

Process parameter validation checklists define approved machine settings, process parameters, and inspection criteria to verify process compliance, maintain consistent garment quality, and prevent manufacturing defects.

PROCESS VALIDATION / RE-VALIDATION						
PART NO	PROCESS STAGE:	MACHINE NO:				
OPERATOR :	PERIOD:					
SR NO	PROCESS PARAMETER	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1						
2						
3						
4						
5						
6						

RESULTS OBTAINED (BASED ON 10 PIECES INSPECTED)						
SR NO	PROCESS PARAMETER & SPEC.	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5
1						
2						

3						
4						
REMARKS:						

CONCLUSION:
BASED ON ABOVE RESULTS FOLLOWING RANGE OF PROCESS
PARAMETERS IS VALIDATED

SR NO	PROCESS PARAMETER	MIN	MAX	REVALIDATION TO BE DONE BY:
1				
2				
3				
4				
6				STUDY CONDUCTED BY:
7				
8				
9				

APPROVED BY:	
--------------	--

Fig. 3.1.25: Process parameter validation checklist

The following are the components of a process validation checklist for an apparel industry:

- **Trimming blade inspection**

Trimming blade inspection records trimming blade condition, stitch formation, thread tension, and seam finishing parameters. The apparel quality analyst verifies these settings and maintains records to ensure proper edge finishing and prevent seam defects.

- **Knitwear seam specification**

Knitwear seam specification defines the required seam construction, stitch balance, thread tension, and appearance standards for flatlock operations. The apparel quality analyst compares machine settings and seam output against the specification sheet to ensure seam quality compliance.

- **Button pull-test report / strength**

Button pull-test report / strength records button placement, stitch formation, and attachment strength parameters. The apparel quality analyst verifies button security through inspection and pull testing to ensure compliance with strength standards.

- **Knife & slit verification log**

Knife & slit verification records buttonhole machine settings, including knife condition, slit dimensions, stitch density, and placement accuracy. The apparel quality analyst verifies these parameters to ensure consistent buttonhole formation and prevent defects.

- **Zipper functionality & clearance checklist**

Zipper functionality & clearance defines inspection points for zipper alignment, clearance, stitch quality, and operational performance. The apparel quality analyst verifies zipper attachment settings and functionality to ensure defect-free zipper application.

- **Ironing/pressing parameter chart (temperature & pressure matrix)**

Ironing/pressing parameter defines the required temperature, pressure, steam level, and processing time for pressing operations. The apparel quality analyst verifies these settings to ensure correct garment shape, finish, and appearance.

- **Fabric inspection log (4-point or 10-point system)**

Fabric inspection defines inspection parameters for lighting, inspection speed, fabric movement, and defect identification accuracy. The apparel quality analyst verifies machine settings and records inspection findings to ensure reliable defect detection and quality evaluation.

UNIT 3.2: Quality Documentation and Records

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe the production and inspection documents used in apparel manufacturing, including trim cards, measurement charts, and sample specifications.
2. Explain the organisational hierarchy in the apparel industry and the responsibilities of personnel involved in production and quality inspection.
3. Prepare control charts and analyse production and inspection records to monitor quality trends and identify process deviations.
4. Explain accurate production and inspection records to ensure quality control, traceability, and regulatory compliance.

3.2.1 Production Inspection Documents

Production inspection documents are standard records used to capture, monitor, and control quality checks performed during garment manufacturing processes. They include inspection criteria, defect records, machine and process verification details, and corrective actions, helping the apparel quality analyst ensure compliance with quality standards and maintain production traceability. These inspection documents are of the following types:

- **Trim card**

A trim card is a production document that contains samples and details of all trims and accessories used in a garment, such as buttons, zippers, labels, threads, and embellishments. The apparel quality analyst uses it to verify trim specifications, colour, size, quality, and approval status during production and inspection.

Shell Fabric-Electric Sky	Cont. Shell Fabric-Blue Navy	Mesh Fabric-Blue Navy	210T-Blue Navy	Lycra Fabric-Blue Navy
				
Whole Body	Upper Middle Sleeve	Body + Hood + PKT Bag	Sleeve + Sleeve Snow Cuff	Cuff
Thread: AR1144 (60 + 27 Tex)	Thread: 11271 (60 + 27 Tex)	Thread: 11271 (27 Tex)	Thread: 11271 (27 Tex)	Thread: 11271 (27 Tex)
Single Layer of Shell Fabric	Non Fuse-KCX-3(White)	Glue Tape	Adhesive	3mm Elastic Cord
				
Thread: AR1144 (27 Tex) In Patch, In PKT Welt, In PKT Facing, FRNT PKT Facing, Garage.	Position: Garage, In PKT Welt	FRONT PKT	FRONT PKT	HEM

Fig. 3.2.1: Trim card

- **Measurement chart**

A measurement chart is a production document that specifies the required garment dimensions, tolerances, and measurement points for each size. The apparel quality analyst uses it to measure garments during inspection and compare actual measurements against approved standards to ensure fit accuracy.

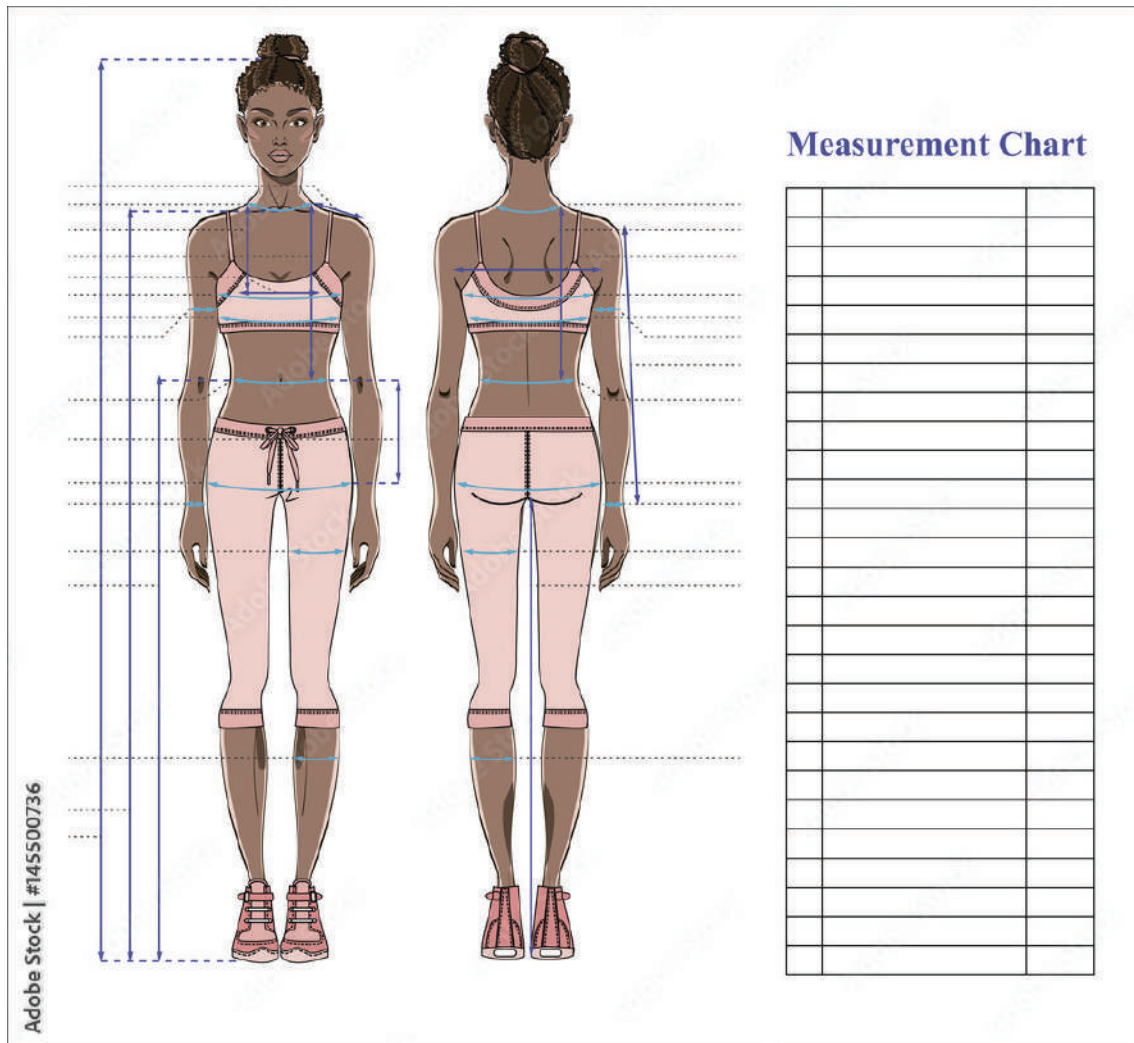


Fig. 3.2.2: Sample measurement chart

- **Sample**

In apparel records, a sample is a physical prototype of a garment made during the design process to test its fit, style, and construction before mass production begins. It serves as an officially approved benchmark that quality teams use to ensure the entire bulk order matches the buyer's exact standards. The following are the different types of samples used in apparel industry:

Sample Type	Purpose
Proto Sample	This initial design prototype is made from available substitute fabrics to evaluate basic styling, aesthetics, and structural silhouette. It validates early concept sketches and pocket or component placement before sourcing final bulk materials.

Sample Type	Purpose
Fit Sample	Cut in a standard base size, this garment uses fabrics with identical weight and drape to check pattern measurements on models. It ensures proper balance, correct ease, and unhindered body movement before proceeding to final grading.
Size Set Sample	This collection spans the entire ordered size range to verify that pattern grading scales proportionately across all measurements. Quality teams inspect these pieces to ensure design details, like collars and pockets, maintain structural balance from XS to XXL.
Pre-Production (PP) Sample	This factory "Golden Sample" is assembled on bulk lines using the exact contract fabrics, threads, trims, and final branding. It serves as the official quality benchmark and requires formal buyer sign-off before mass fabric cutting can begin.
Top of Production (TOP) Sample	This piece is randomly pulled from the initial 10% to 20% of the active bulk manufacturing run. Quality analysts inspect it to verify that the mass assembly line accurately mirrors the approved pre-production quality standards.
Shipment Sample	Extracted from finalised, packed export cartons, this garment represents the absolute final state of the commercial shipment. It is permanently archived by both parties as a legal reference to settle any potential post-delivery quality disputes.

Table 3.2.1: Apparel industry garment samples

3.2.2 Production Quality Hierarchy

Production quality hierarchy refers to the structured chain of roles and responsibilities followed in an apparel organisation to manage quality from raw material inspection to final product shipment. It ensures coordination between departments and defines the flow of quality decisions, approvals, and corrective actions at each production stage. Hierarchical stages in apparel production quality flow:

- Management and merchandising teams define quality policies, buyer requirements, orders, approvals, and delivery schedules.
- Planning and material teams manage production schedules, resources, and availability of approved fabrics, trims, and accessories.
- Quality teams perform material inspection, process monitoring, defect identification, and corrective actions to ensure compliance.
- Production teams convert approved materials into finished garments through cutting, stitching, finishing, and packing processes.
- Final inspection and shipment teams verify product quality and approve garments for dispatch to customers and markets.

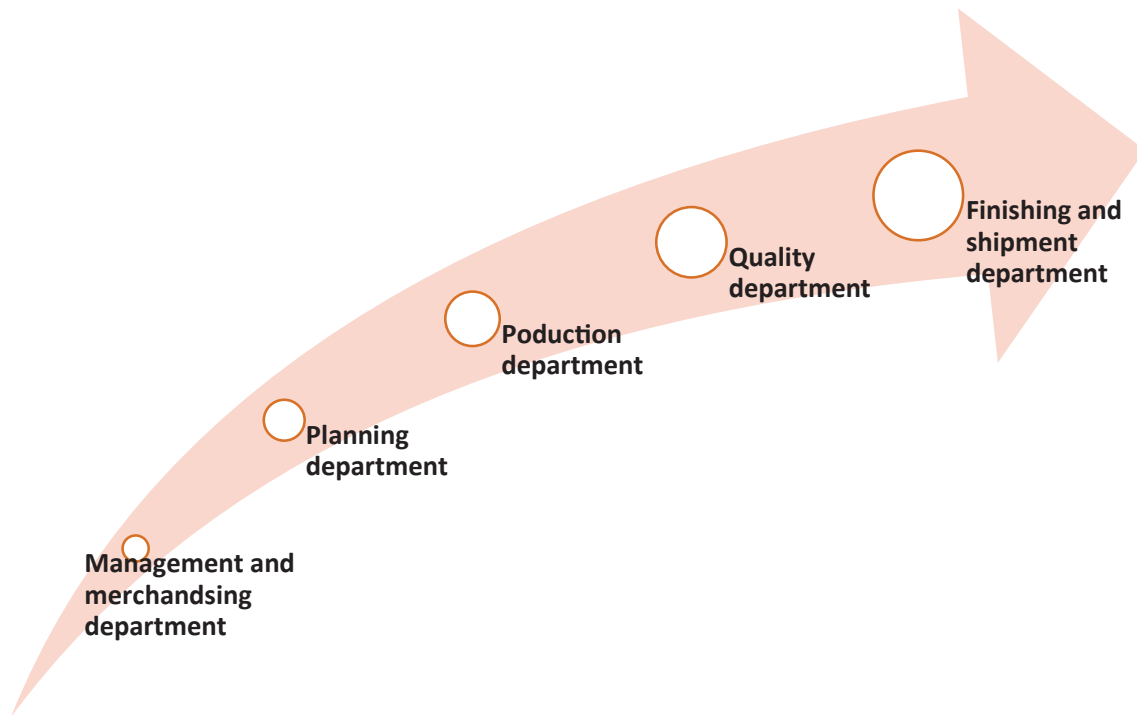


Fig. 3.2.3: Production quality hierarchy departments

Quality monitoring is carried out at different production stages to identify defects, ensure process compliance, and maintain garment quality from raw material to shipment:

Production stage	Quality monitoring activity
Raw material inspection	Fabrics, trims, and accessories are inspected against approved specifications to identify defects before production begins.
Fabric spreading and cutting	Fabric placement, marker alignment, cutting accuracy, and cut panel quality are monitored to prevent size and shape variations.
Sewing and assembly	Stitch quality, seam strength, measurements, machine settings, and workmanship are checked during production to identify and correct defects.
In-line inspection	Garments are inspected during sewing operations to detect recurring defects and implement immediate corrective actions.
End-line inspection	Completed garments from production lines are checked for appearance, measurements, finishing quality, and compliance before moving to finishing.
Finishing and pressing	Garment appearance, pressing quality, thread trimming, stains, and final workmanship are monitored before packing.
Final inspection	Finished garments are inspected against buyer standards, specifications, and quality requirements before shipment approval.
Packing and shipment	Packaging, labelling, quantity, and shipment documentation are verified to ensure correct delivery to customers.

Table 3.2.2: Quality monitoring stages in production

3.2.3 Control Chart Analysis

What is a control chart?

A control chart is a quality monitoring tool used to track process performance and identify variations during production over time. The apparel quality analyst uses control charts to compare inspection data against control limits, detect abnormal variations, and take corrective actions to maintain consistent quality.

- **Parts of a control chart**

The following are the parts of a control chart:

- **Central line**

The central line represents the average quality performance level, such as average defect rate or measurement value, and the apparel quality analyst uses it as a reference to compare actual production performance.

- **Upper control limit (UCL)**

The upper control limit indicates the maximum acceptable variation in quality parameters, and the apparel quality analyst uses it to identify when defects or variations exceed acceptable levels and require corrective action.

- **Lower control limit (LCL)**

The lower control limit indicates the minimum acceptable process variation, and the apparel quality analyst monitors it to detect unusual process changes affecting garment quality.

- **Data points**

Data points represent actual inspection results, such as defect counts, measurements, or process values, and the apparel quality analyst records and analyses them to monitor production stability.

- **Control limits**

Control limits define the acceptable range of quality variation during production, and the apparel quality analyst uses them to determine whether the process is under control or needs improvement.

- **Time or sample axis**

The time or sample axis shows the sequence of production batches, inspection periods, or garment samples, and the apparel quality analyst uses it to identify quality trends and recurring issues over time.

The stages of a control chart analysis

Control chart analysis helps monitor production quality by analysing variations in process performance and identifying whether the process remains within acceptable limits. The apparel quality analyst uses control chart analysis to detect defects, identify trends, and implement corrective actions for process improvement:

Stage	Description
Data collection	The apparel quality analyst collects quality data such as defect counts, measurements, or process parameters from production and inspection records.
Data plotting	The collected quality data is plotted on the control chart to compare actual performance against the central line and control limits.
Variation analysis	The apparel quality analyst analyses data patterns to identify normal variations, trends, or abnormal deviations affecting garment quality.

Stage	Description
Process evaluation	The process is evaluated to determine whether production performance remains within acceptable control limits or requires investigation.
Root cause identification	The apparel quality analyst investigates the causes of abnormal variations using defect records, process observations, and quality analysis tools.
Corrective action implementation	Corrective actions are applied to address identified causes, improve process control, and prevent recurrence of defects.
Continuous monitoring	The apparel quality analyst continues tracking quality data to verify process stability and maintain consistent garment quality.

Table 3.2.3: Stages of control chart analysis

3.2.4 Production Record Maintenance

What is a production record?

A production record is a document that captures details of garment manufacturing activities, including production output, process performance, material usage, and quality observations. The apparel quality analyst uses production records to track production progress, analyse defects, maintain traceability, and support quality improvement actions.

Line No.:-

Date:-

Buyer:-

Style:-

Color:-

Time	Production Counting	Total	Grand Total	Signature		Remarks
				Supervisor	QC	

Fig. 3.2.4: Production record sample template

Types of production records and their maintenance

The following are the types of production records used in apparel manufacturing and their maintenance:

- **Production order record**

A production order record contains garment style, quantity, specifications, and delivery details used for production planning and tracking. The apparel quality analyst maintains it by verifying approvals, revisions, and production requirements.

- **Production process record**

A production process record captures details of cutting, stitching, finishing, output, and process performance used to monitor manufacturing activities. The apparel quality analyst maintains it by recording production data, checking process compliance, and tracking quality observations.

- **Inspection and defect record**

An inspection and defect record captures inspection results, defect types, frequency, and corrective actions used for quality monitoring and improvement. The apparel quality analyst maintains it by updating inspection findings, analysing defect trends, and verifying corrective actions.

- **Packing and shipment record**

A packing and shipment record contains details of packed quantities, labels, cartons, and shipment approvals used to ensure accurate product dispatch. The apparel quality analyst maintains it by verifying packing information, inspection approval, and shipment compliance.

Summary

- Production and inspection documents help record quality information throughout the apparel manufacturing process.
- Common quality documents include trim cards, measurement charts, sample records, control charts, and inspection records.
- A clear organisational hierarchy defines the roles and responsibilities of production and quality personnel.
- Quality monitoring is carried out at different stages of production to ensure compliance with quality standards.
- Fabrics and raw materials are inspected to identify defects before they enter the production process.
- Patterns, templates, and fabric cutting preparations are verified to ensure production accuracy.
- Machine settings and attachments must be checked before production to maintain consistent product quality.
- Control charts help monitor process performance and identify variations or deviations from quality standards.
- Production and inspection records provide valuable information for analysing quality trends and process performance.
- Accurate documentation improves traceability, accountability, and regulatory compliance.
- Quality data analysis supports timely corrective actions and continuous process improvement.
- Proper quality documentation and monitoring help improve product quality, production efficiency, and customer satisfaction.

Exercise

Multiple-choice Question:

1. Which document is commonly used to record garment measurements during production?
 - a. Attendance register
 - b. Measurement chart
 - c. Delivery challan
 - d. Salary register
2. Why are fabrics and raw materials inspected before production?
 - a. To increase production speed
 - b. To identify defects and verify quality standards
 - c. To reduce worker attendance
 - d. To prepare invoices
3. What is the primary purpose of a control chart?
 - a. To monitor process performance and identify deviations
 - b. To record employee leave
 - c. To calculate production cost
 - d. To schedule deliveries
4. Why are machine settings checked before production begins?
 - a. To improve packaging
 - b. To ensure production and quality requirements are met
 - c. To reduce warehouse space
 - d. To increase advertising
5. Why is accurate production documentation important?
 - a. To increase paperwork
 - b. To support quality control, traceability, and compliance
 - c. To reduce inspection activities
 - d. To monitor employee salaries

Descriptive Questions:

1. Explain the importance of production and inspection documents in apparel manufacturing.
2. Describe the quality monitoring activities carried out during different stages of apparel production.
3. Explain the procedures for inspecting raw materials, patterns, templates, and machine settings before production.
4. Describe the role of control charts and production records in monitoring quality performance.
5. Explain the importance of maintaining accurate production and inspection documentation for quality control and regulatory compliance.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

QA in garment production for production quality



Understanding control chart analysis





4. Integrate Digital and AI Tools in Quality Assurance Systems

Unit 4.1 - AI Quality Systems Fundamentals

Unit 4.2 - AI Quality Data Analysis



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Explain the role and importance of digital and AI-enabled tools in apparel quality assurance and production monitoring.
2. Describe different AI-based inspection systems, digital dashboards, and their applications in detecting garment defects and monitoring quality.
3. Compare AI-enabled inspection systems and digital quality dashboards to monitor production performance and apparel quality in real time.
4. Outline production data, quality reports, and defect trends generated by AI tools to identify patterns and determine root causes.
5. Elaborate on the effectiveness of AI-integrated quality assurance systems in reducing defects, improving efficiency, and ensuring compliance with quality standards.
6. Discuss the corrective and preventive actions using AI-driven insights to improve product quality and production performance.
7. Prepare data-driven quality reports and visual dashboards to support quality analysis, decision-making, and management review.
8. Discuss the integration of digital and AI-enabled quality assurance tools with conventional inspection processes to enhance overall manufacturing efficiency.

UNIT 4.1: AI Quality Systems Fundamentals

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the role and significance of digital and AI-enabled tools in apparel quality assurance and production monitoring.
2. Describe the various AI-based inspection systems, digital dashboards, and their use in identifying garment defects and tracking quality performance.
3. Compare AI-enabled inspection systems and digital quality dashboards for monitoring production performance and apparel quality in real time.
4. Discuss the integration of digital and AI-enabled quality assurance tools with traditional inspection methods to improve overall manufacturing efficiency.

4.1.1 Digital AI Tools in Quality Assurance

Digital and AI tools in apparel quality assurance automate inspection, analyse quality data, and improve defect detection, accuracy, and decision-making in garment production. AI-based computer vision inspection systems are adopted by textile manufacturers, with the Ministry of Textiles promoting the adoption of such advanced technologies through the Amended Technology Upgradation Fund Scheme (ATUFS).

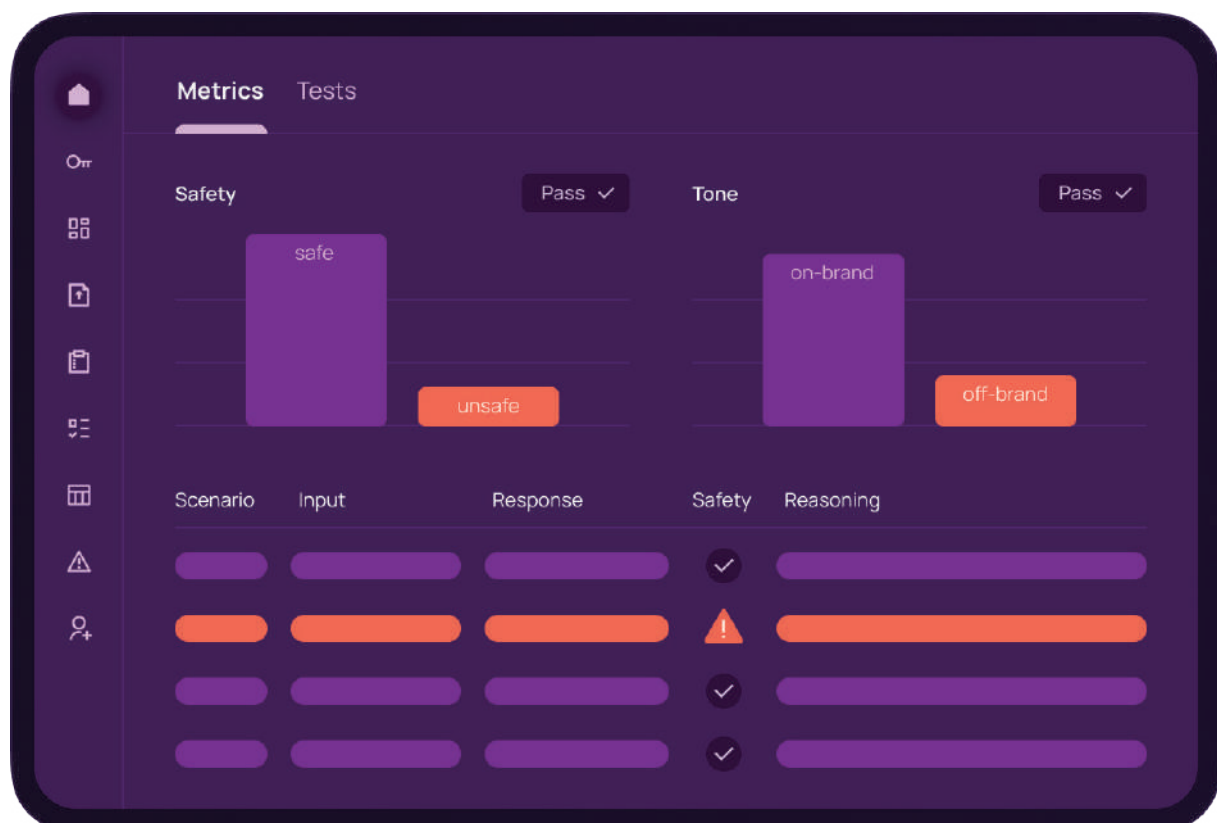


Fig. 4.1.1: AI-based digital quality assurance system sample dashboard

The following are the five main types of digital and AI tools used in quality assurance across different stages of garment production:

AI-based digital tool	Purpose in apparel quality assurance	Government of India initiative
AI-based visual inspection tools	Use computer vision and machine learning to automatically detect defects such as stains, holes, fabric faults, and stitching errors during fabric and garment inspection.	Ministry of Textiles digital manufacturing initiatives and technology upgradation programmes
Digital quality management systems (QMS)	Record inspection data, manage defects, track corrective actions, and monitor quality performance throughout the production process.	Amended Technology Upgradation Fund Scheme (ATUFS)
AI-based defect prediction and analytics tools	Analyse production data, defect trends, and process variations to predict quality issues and support preventive quality control.	National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS)
Digital measurement and fit analysis tools	Use 3D scanning, digital pattern technology, and automated measurement systems to verify garment dimensions, fit, and size accuracy.	Digital initiatives of the National Institute of Fashion Technology (NIFT)
IoT-based production monitoring tools	Use connected sensors and smart devices to monitor machine performance, production output, and process conditions in real time.	SAMARTH (Scheme for Capacity Building in Textile Sector) and Industry 4.0 initiatives

Table 4.1.1: AI-based quality assurance system types

4.1.2 AI Inspection Systems and Dashboards

AI inspection systems and dashboards use artificial intelligence to inspect garments, analyse quality data, detect defects, and monitor production performance in real time. These systems improve inspection accuracy, support faster decision-making, and enhance overall quality management in apparel manufacturing.

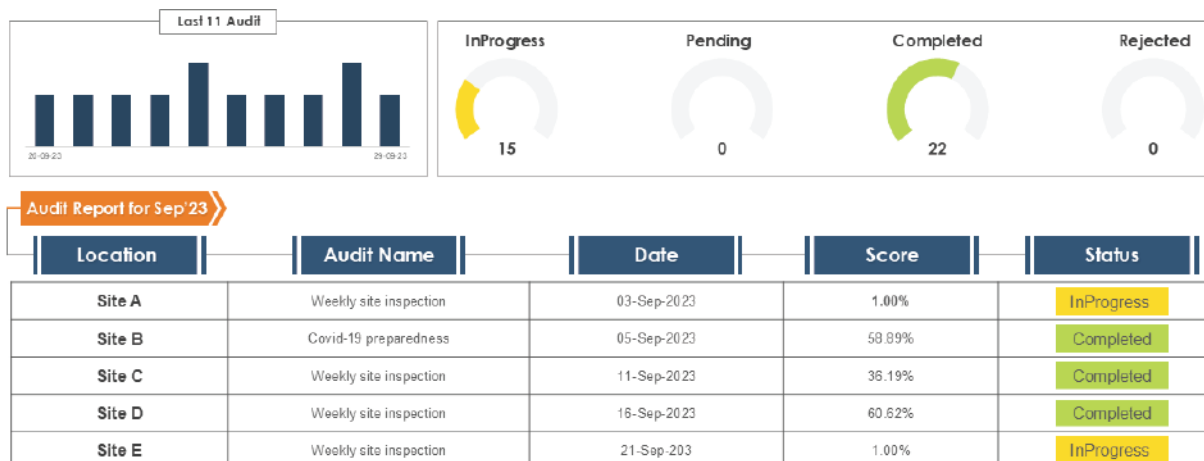


Fig. 4.1.2: AI inspection system and production quality dashboard sample

AI-inspection tools:

AI-inspection tools use Artificial Intelligence (AI), computer vision, machine learning, and image processing technologies to automatically inspect fabrics, garments, and production processes for quality defects. These tools analyse images and inspection data in real time to detect defects, classify quality issues, measure product specifications, and generate accurate inspection results with minimal human intervention. By improving inspection speed, consistency, and accuracy, they enable apparel quality analysts to identify defects early, reduce rework and rejection, maintain product quality, and support data-driven quality assurance. The following are some of the commonly used AI inspection systems (tools) in apparel quality assurance:

AI inspection tool	Quality parameters monitored	Purpose in apparel quality assurance	Application by Apparel Quality Analyst
Inspectorio	AQL results, defect rate, defect type, supplier quality score, inspection status, corrective actions	Digitises garment inspections, monitors supplier quality, identifies recurring defects, and supports data-driven quality improvement.	Reviews digital inspection reports, analyses recurring defects, monitors supplier quality performance, and initiates corrective actions based on quality data.
Coats Digital VisionPLM	DHU, FPY, rejection rate, rework rate, production quality trends, quality KPIs	Monitors product quality across manufacturing stages and supports continuous quality improvement through real-time analytics.	Tracks quality KPIs, monitors production quality trends, identifies quality deviations, and recommends process improvements to reduce defects and rework.
Lectra Fashion on Demand	Production efficiency, garment quality status, machine utilisation, defect trends, order progress	Integrates production and quality information to improve manufacturing efficiency and reduce quality issues.	Monitors real-time production quality, identifies quality issues during manufacturing, and coordinates timely corrective actions with production teams.
Siemens Opcenter Quality	Non-conformance reports, CAPA status, inspection records, process capability, audit findings	Digitally manages quality inspections, non-conformance tracking, corrective actions, and process quality compliance.	Records inspection results, tracks non-conformities, monitors CAPA implementation, and ensures compliance with quality management procedures.
SAP Digital Manufacturing	Overall Equipment Effectiveness (OEE), yield, defect trends, downtime, quality alerts, production performance	Provides real-time visibility of manufacturing quality and supports faster quality-related decision-making.	Reviews quality alerts, monitors production quality performance, analyses defect trends, and supports data-driven quality decisions during production.

AI inspection tool	Quality parameters monitored	Purpose in apparel quality assurance	Application by Apparel Quality Analyst
Microsoft Power BI (Quality Analytics)	DHU, FPY, Pareto analysis, rejection trends, operator performance, defect distribution	Visualises quality data using interactive dashboards to identify trends, monitor performance, and support management reporting.	Generates quality dashboards, performs trend and Pareto analysis, prepares quality reports, and presents quality performance to supervisors and management.
Qarma	Inspection scores, defect categories, supplier performance, audit status, corrective actions	Supports digital quality inspections, supplier audits, and quality performance monitoring across manufacturing facilities.	Conducts digital inspections, monitors supplier audit results, evaluates quality performance, and follows up on corrective actions with suppliers.
SoftExpert EQM	Audit compliance, CAPA progress, customer complaints, inspection results, quality metrics	Integrates enterprise quality management processes and provides real-time monitoring of quality performance.	Monitors audit compliance, tracks CAPA progress, analyses customer complaints, and maintains enterprise quality records for continuous improvement.

Table 4.1.2: AI Inspection tools

AI-inspection dashboards:

Digital quality dashboards provide a visual and real-time representation of quality data collected from inspection systems, production lines, quality management systems, and manufacturing operations. They present key quality indicators through charts, graphs, tables, and performance metrics, enabling apparel quality analysts to monitor product quality, identify quality trends, detect process deviations, evaluate supplier and production performance, and support timely, data-driven decision-making for continuous quality improvement. The following are some of the commonly used digital quality dashboards in apparel quality assurance:

Digital quality dashboard	Description
Inspectorio Quality Dashboard	Displays real-time inspection results, supplier quality performance, AQL status, defect trends, and corrective actions in a single interface. It helps quality analysts monitor inspection activities, identify recurring defects, and make faster quality decisions.
VisionPLM Quality Analytics Dashboard	Provides a visual overview of product quality throughout the product lifecycle by integrating design, development, and production quality data. It enables quality teams to monitor key quality indicators, analyse trends, and improve product consistency.
Production and Quality Dashboard	Combines production progress and quality inspection data into a single dashboard for real-time monitoring. It helps identify quality issues alongside production performance, allowing quicker corrective action during manufacturing.

Digital quality dashboard	Description
Quality Management Dashboard	Displays inspection records, non-conformance reports, CAPA status, audit findings, and process compliance information. It supports systematic quality management by tracking quality activities and ensuring compliance with organisational quality standards.
Manufacturing Insights Dashboard	Presents live manufacturing and quality metrics such as OEE, production yield, defect rates, downtime, and quality alerts. It enables quality analysts to monitor factory performance and respond quickly to emerging quality issues.
Interactive Quality Dashboard	Uses interactive charts, graphs, and filters to visualise quality data such as DHU, FPY, rejection trends, Pareto analysis, and operator performance. It allows users to explore quality data, identify patterns, and support data-driven decision-making.
Quality Control Dashboard	Summarises inspection scores, defect categories, supplier performance, audit status, and corrective action progress. It provides a comprehensive view of quality control activities and helps monitor product quality across suppliers and production units.
Enterprise Quality Dashboard	Integrates quality information from multiple departments, including inspections, audits, CAPA, customer complaints, and compliance records. It provides management with an organisation-wide view of quality performance to support continuous improvement and strategic decision-making.

Table 4.1.3: Digital Quality Dashboards Used in Apparel Quality Assurance

4.1.3 AI Inspection Systems Performance Comparison

AI inspection systems performance comparison evaluates the accuracy, speed, reliability, and defect detection capability of AI inspection systems and digital dashboards used in apparel manufacturing. It helps apparel quality analysts select suitable systems and improve real-time quality monitoring and inspection efficiency.

AI quality monitoring system

AI-enabled inspection systems and digital dashboards use artificial intelligence to detect garment defects, analyse inspection data, and monitor production quality in real time. In India, their adoption is promoted through digital manufacturing initiatives of the Ministry of Textiles and smart manufacturing programmes that support AI-based quality monitoring and decision-making.

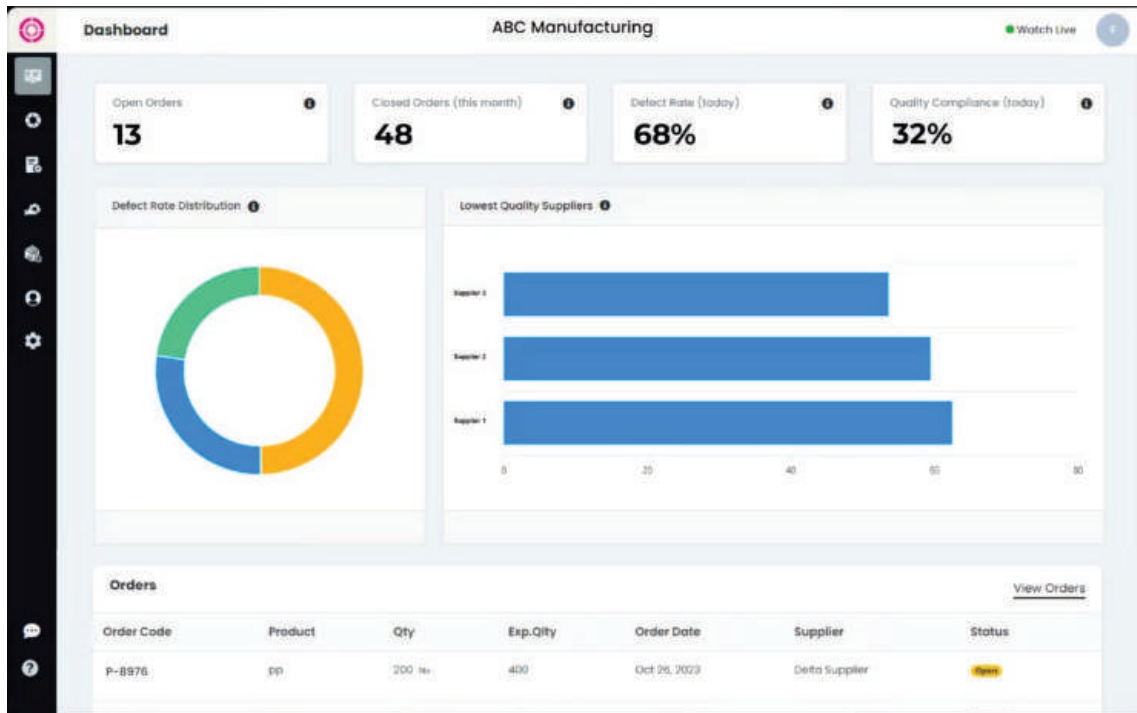


Fig. 4.1.3: AI quality monitoring system dashboard sample

The following table compares the key performance metrics used to evaluate different AI inspection systems and digital dashboards in apparel quality assurance:

AI inspection system	Performance comparison metrics
AI-based fabric inspection systems	Compared by fabric defect detection accuracy, inspection speed, false detection rate, and fabric coverage.
AI-based garment inspection systems	Compared by stitching defect detection accuracy, measurement accuracy, finishing defect detection, and inspection consistency.
AI quality dashboards	Compared by real-time KPI monitoring, dashboard response time, data visualisation, reporting accuracy, and decision support capability.
AI defect analytics systems	Compared by defect prediction accuracy, root cause analysis capability, trend identification, and analytical performance.
AI production monitoring dashboards	Compared by real-time production monitoring, machine utilisation tracking, production efficiency analysis, quality monitoring, and alert generation.

Table 4.1.4: AI inspection system performance comparison

4.1.4 Digital AI Quality Tools Integration

Digital AI quality tools integration is the process of combining AI-enabled inspection systems, digital quality tools, and production monitoring platforms to improve apparel quality management. It helps apparel quality analysts reduce defects, improve production efficiency, strengthen process control, and ensure compliance with quality standards.

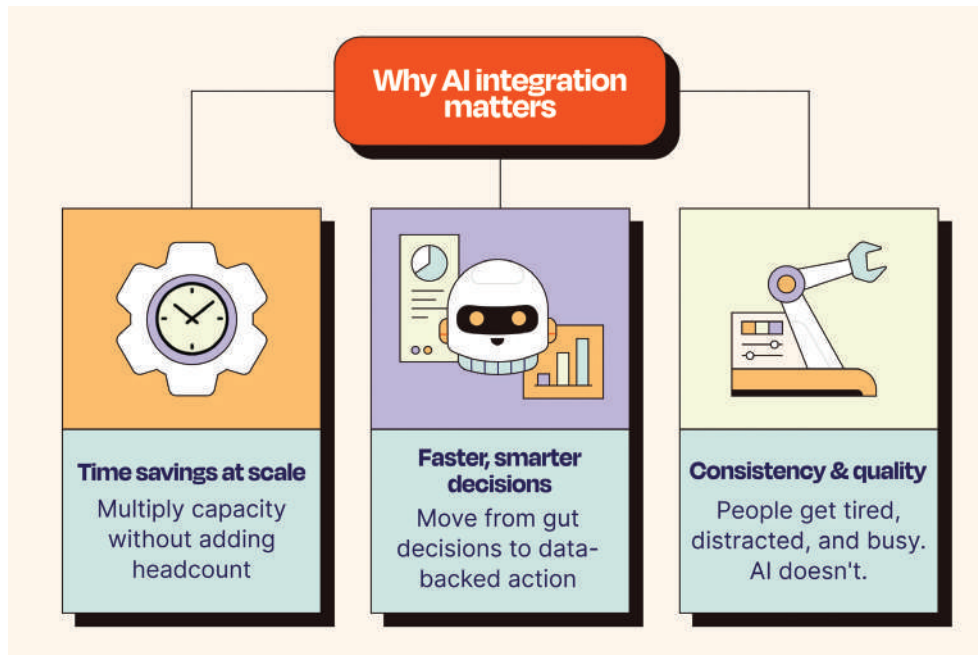


Fig. 4.1.4: Importance of AI integration

The following are the five main areas of AI integration in apparel quality assurance:

- **AI-integrated fabric quality monitoring**

AI-integrated fabric quality monitoring combines automated fabric inspection systems with digital quality records to identify fabric defects in real time. Digital manufacturing initiatives supported by the Ministry of Textiles promote the adoption of such technologies to improve raw material quality.

- **AI-integrated garment inspection**

AI-integrated garment inspection combines computer vision, automated inspection systems, and digital quality records to identify stitching, measurement, and finishing defects accurately. These systems support Industry 4.0 adoption in Indian apparel manufacturing by improving inspection speed and consistency.

- **AI-integrated quality dashboards**

AI-integrated quality dashboards combine inspection, production, and defect data to display real-time quality KPIs, defect trends, DHU, FPY, rework, and rejection rates. Government-supported digital manufacturing programmes encourage industries to use integrated dashboards for continuous quality monitoring and decision-making.

- **AI-integrated predictive quality analytics**

AI-integrated predictive quality analytics combines AI algorithms with production and inspection data to predict defects, identify root causes, and recommend corrective actions. These technologies support smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS).

- **AI-integrated smart production monitoring**

AI-integrated smart production monitoring combines IoT devices, machine data, production information, and AI analytics to monitor machine performance, production efficiency, and product quality in real time. Government initiatives such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote awareness of integrated AI technologies for quality improvement in the textile and apparel industry.

UNIT 4.2: AI Quality Data Analysis

Unit Objectives

By the end of this unit, the participants will be able to:

1. Outline the production data, quality reports, and defect patterns generated through AI tools to identify trends and analyse root causes.
2. Elaborate on the benefits of AI-integrated quality assurance systems in minimising defects, enhancing operational efficiency, and maintaining compliance with quality standards.
3. Discuss the corrective and preventive measures derived from AI-driven insights to enhance product quality and production performance.
4. Prepare data-driven quality reports and interactive dashboards to facilitate quality analysis, informed decision-making, and management review.

4.2.1 AI-Generated Production Data Analysis

Production data analysis is the process of collecting, analysing, and interpreting production and quality data to monitor performance, identify defects, and improve manufacturing efficiency. AI-generated production data analysis is the process of using artificial intelligence to automatically collect, analyse, and interpret production and quality data to identify defects, monitor performance, and support data-driven decision-making in apparel manufacturing.

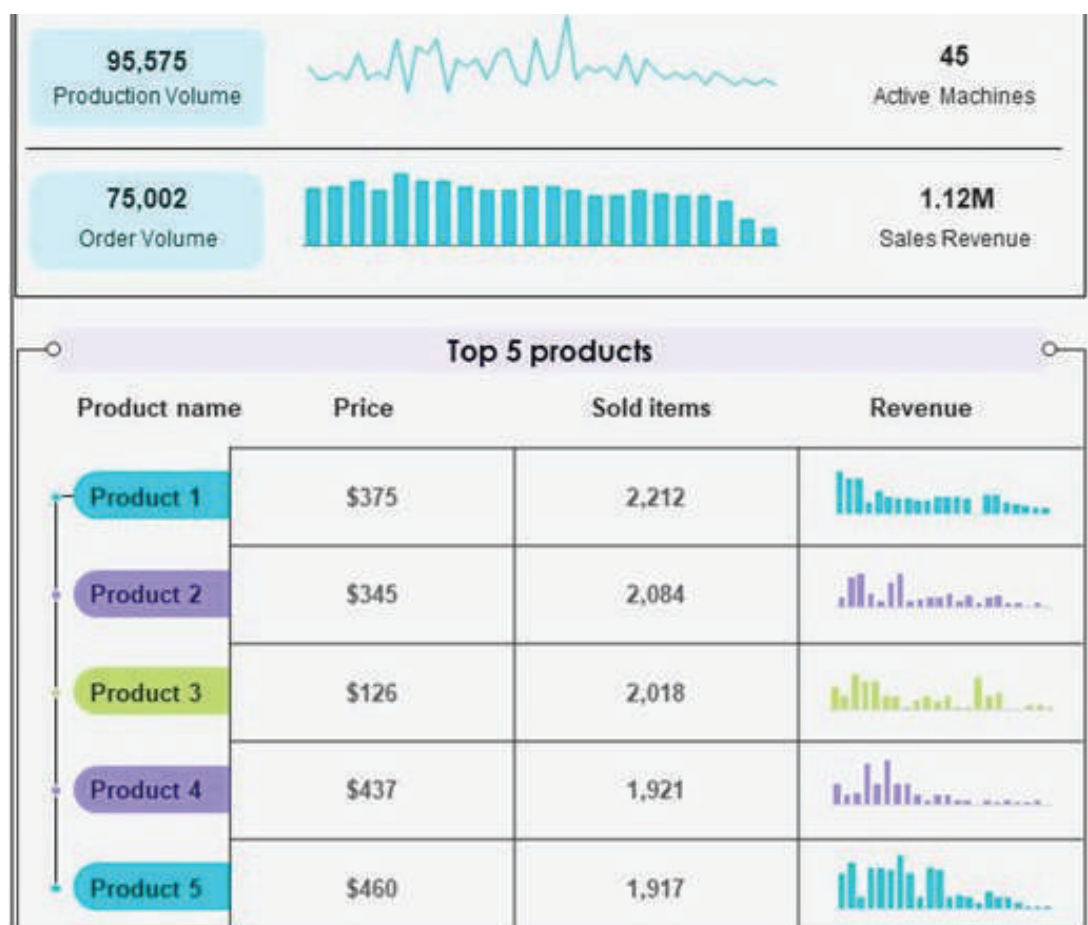


Fig. 4.2.1: AI-based production data analysis dashboard sample

AI-generated production data analysis helps in the following ways:

- **Production outputs**

AI analyses production output data such as target achievement, line efficiency, operator performance, and machine utilisation to identify productivity gaps, determine root causes, and recommend process improvements. Government initiatives under the Ministry of Textiles and smart manufacturing programmes promote AI-enabled production monitoring to improve manufacturing efficiency.

- **Defect reports**

AI analyses defect type, frequency, location, and occurrence patterns to identify recurring defects, determine root causes, and recommend preventive and corrective actions. AI-driven defect analytics support quality improvement under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS).

- **Reducing defects**

AI identifies recurring quality issues by analysing inspection data, process parameters, and historical defect records to recommend actions that reduce defect occurrence. Industry 4.0 initiatives supported by the Ministry of Textiles encourage AI-based quality improvement in apparel manufacturing.

- **Improving efficiency**

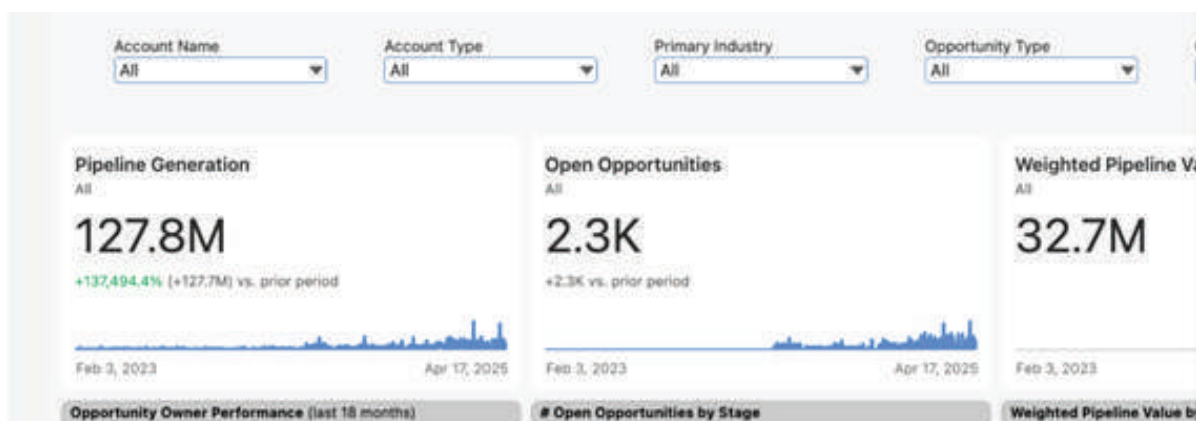
AI analyses production flow, machine utilisation, downtime, operator productivity, and process performance to identify inefficiencies and recommend optimisation measures. Government-supported smart manufacturing initiatives promote AI integration for improving operational efficiency in textile and apparel units.

- **Meeting quality standards**

AI compares inspection results, production data, and quality parameters with approved buyer and organisational standards to identify non-conformities and recommend corrective actions. Programmes such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote awareness of AI-enabled quality management systems to achieve consistent compliance with quality standards.

4.2.2 AI-Integrated Quality Assurance Benefits

AI-integrated quality assurance is the use of artificial intelligence to automate quality inspections, monitor production processes, and ensure compliance with industry standards in apparel manufacturing. AI-integrated quality assurance helps apparel quality analysts improve inspection accuracy, reduce defects, enhance efficiency, and comply with digital quality assurance requirements.



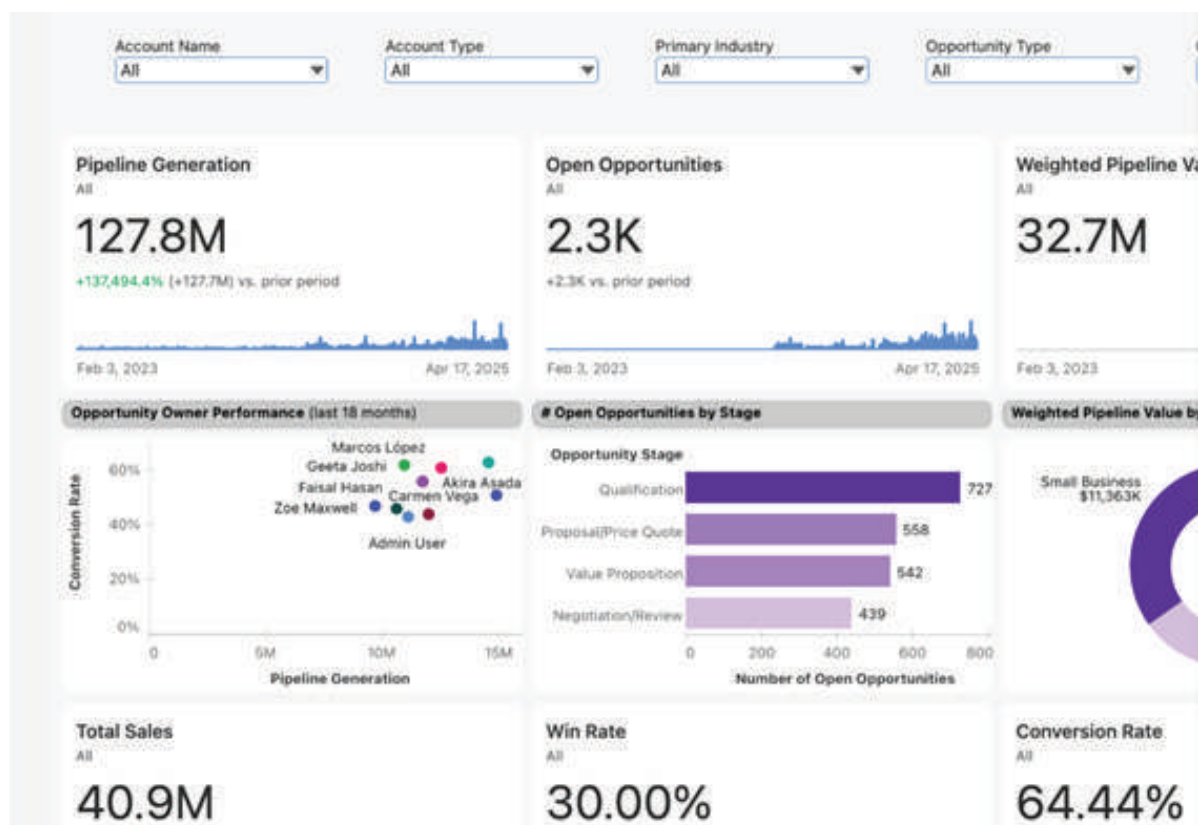


Fig. 4.2.2: AI-based quality assurance dashboard sample

AI-integrated quality assurance provides the following benefits:

- **Compliance with industry standards**

AI compares production and inspection data with approved buyer, organisational, and regulatory quality standards to identify non-conformities and recommend corrective actions. Government initiatives under the Ministry of Textiles promote the adoption of digital quality systems to strengthen quality compliance in apparel manufacturing.

- **Improved defect detection**

AI analyses images, measurements, and inspection data to identify fabric, stitching, finishing, and measurement defects with greater speed and accuracy. Smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) support AI-enabled defect detection technologies.

- **Higher production efficiency**

AI monitors production flow, machine performance, operator productivity, and process efficiency to identify bottlenecks and recommend improvements. Government-supported digital manufacturing programmes encourage AI integration to improve operational efficiency in textile and apparel units.

- **Data-driven quality decisions**

AI analyses quality data, defect trends, and production performance to generate insights that support faster and more accurate quality decisions. Digital transformation initiatives promoted by the Ministry of Textiles encourage industries to adopt AI-based decision-support systems.

- **Real-time quality monitoring**

AI continuously monitors production quality through integrated inspection systems and digital dashboards to detect process variations and quality deviations instantly. Programmes such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote awareness of AI-enabled quality monitoring for consistent compliance with apparel quality standards.

4.2.3 AI-Driven Corrective Preventive Measures

Corrective and preventive measures are actions taken to eliminate existing quality problems and prevent their recurrence during apparel manufacturing. AI-driven corrective and preventive measures use artificial intelligence to analyse production and inspection data, identify root causes, recommend corrective actions, and integrate digital AI tools with conventional quality assurance processes to improve overall efficiency.

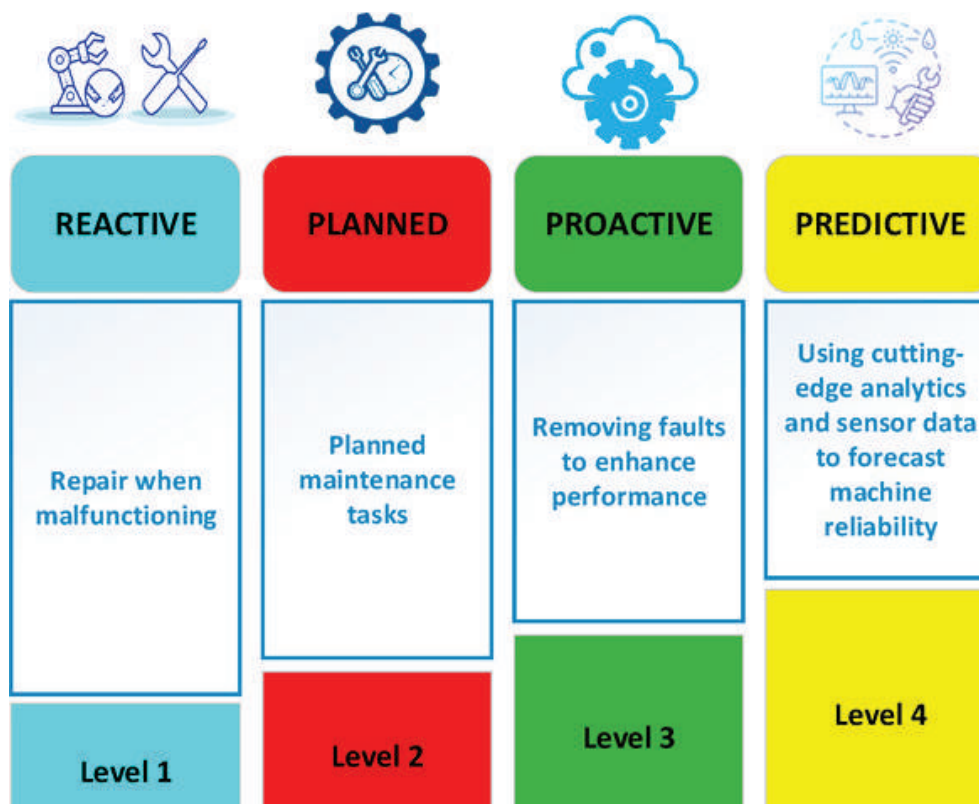


Fig. 4.2.3: AI-driven corrective and preventive measures help in the following ways:

- **Root cause identification**

AI analyses production outputs, inspection results, and defect reports to identify the root causes of recurring quality issues and process variations. Smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) promote AI-enabled root cause analysis for quality improvement.



Fig. 4.2.4: NM-ICPS official logo

- **Corrective action recommendations**

AI recommends corrective actions such as machine setting adjustments, process modifications, operator guidance, and material improvements to eliminate identified defects. Government initiatives under the Ministry of Textiles encourage the adoption of AI-supported quality improvement systems.

- **Preventive quality control**

AI continuously monitors production and inspection data to predict potential quality issues before defects occur and recommends preventive measures. AI integration with conventional quality assurance processes improves process stability and reduces defect recurrence.

- **Digital quality integration**

AI integrates inspection systems, digital dashboards, and production data with existing quality assurance procedures to improve inspection efficiency, traceability, and decision-making. Government-supported digital manufacturing programmes promote the integration of AI technologies into conventional quality systems.

- **Quality standards compliance**

AI verifies that corrective and preventive actions comply with approved buyer specifications, organisational procedures, and regulatory quality standards before production continues. Programmes such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote AI-enabled quality management for consistent compliance.

4.2.4 Data-Driven Quality Reports Dashboards

Data-driven quality reports and dashboards automatically collect, analyse, and present production and quality information using artificial intelligence for management review and decision-making. They help apparel quality analysts generate visual reports, monitor quality performance in real time, and support continuous process improvement.

Data Quality Dashboard Template Example



Fig. 4.2.5: AI-based data-driven quality dashboard sample template

AI-driven quality reports and dashboards support the following:

- **Production performance reports**

AI generates reports on production output, line efficiency, machine utilisation, and operator performance to evaluate manufacturing productivity. Government-supported digital manufacturing initiatives encourage automated production reporting for management review.

- **Defect analysis reports**

AI analyses defect type, frequency, location, and trends to generate reports that support root cause analysis and quality improvement. AI-enabled analytics are promoted under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS).

- **Visual quality dashboards**

AI dashboards display real-time quality indicators such as DHU, FPY, defect rate, rejection rate, rework rate, and production performance using interactive visual charts. The Ministry of Textiles promotes digital quality monitoring through smart manufacturing initiatives.

- **Compliance reports**

AI generates reports comparing inspection results with buyer specifications, organisational procedures, and regulatory quality standards to verify compliance. Digital quality assurance systems improve documentation accuracy and audit readiness.

- **Management review dashboards**

AI combines production, inspection, and quality data into visual dashboards that provide actionable insights, performance trends, and improvement recommendations for management review. Programmes such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote awareness of AI-enabled dashboards for data-driven quality management.

Summary

- Digital and AI-enabled tools improve apparel quality assurance by enabling faster, more accurate, and real-time production monitoring.
- AI-based inspection systems automatically detect garment defects such as stitching errors, fabric flaws, colour variations, and measurement deviations.
- Digital quality dashboards display live production and quality data to help monitor performance and identify issues quickly.
- AI-enabled inspection systems and digital dashboards support timely decision-making by providing real-time quality insights.
- AI tools generate production data, quality reports, and defect trend analyses that help identify recurring quality problems.
- Analysing AI-generated data helps determine the root causes of defects and supports continuous quality improvement.
- AI-integrated quality assurance systems reduce manual inspection effort, improve inspection accuracy, and minimise production defects.
- AI-driven quality monitoring improves production efficiency while ensuring compliance with organisational and industry quality standards.
- Corrective and preventive actions based on AI insights help reduce recurring defects and improve overall production performance.
- Data-driven quality reports and visual dashboards support quality analysis, management review, and informed decision-making.
- Integrating AI-enabled quality tools with conventional inspection processes creates a more reliable and efficient quality assurance system.
- Digital and AI-based quality assurance enhances product consistency, customer satisfaction, operational efficiency, and overall manufacturing performance.

Exercise

Multiple-choice Question:

1. What is the primary role of AI-enabled tools in apparel quality assurance?
 - a. To increase manual paperwork
 - b. To improve quality monitoring and defect detection
 - c. To reduce employee attendance
 - d. To prepare production invoices

2. What is the main purpose of a digital quality dashboard?
 - a. To record employee salaries
 - b. To display real-time production and quality information
 - c. To prepare shipping documents
 - d. To maintain attendance records

3. Why are AI-generated quality reports important?
 - a. To increase production costs
 - b. To identify defect trends and analyse root causes
 - c. To reduce machine maintenance
 - d. To schedule worker shifts

4. How do AI-driven corrective and preventive actions benefit production?
 - a. By increasing production delays
 - b. By reducing recurring defects and improving quality performance
 - c. By eliminating quality inspections completely
 - d. By reducing customer feedback

5. Why are AI-enabled quality tools integrated with traditional inspection methods?
 - a. To replace production planning
 - b. To enhance manufacturing efficiency and quality assurance
 - c. To increase manual inspections only
 - d. To reduce production capacity

Descriptive Questions:

1. Explain the role of digital and AI tools in apparel quality assurance and production monitoring.
2. Describe the use of AI inspection systems and digital dashboards for defect detection and quality monitoring.
3. Explain how AI-generated data and reports identify defect trends and root causes.
4. Describe the benefits of AI-enabled quality assurance and corrective actions in improving product quality.
5. Explain the importance of AI-enabled quality reporting and integration with conventional inspection processes.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/0ZuHnJkAZiQ>

AI usage in apparel industry



5. Utilise AI-Based Analytics for Quality Monitoring



Unit 5.1 - AI-Powered Quality Analysis and Improvement



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Describe the principles of AI-based analytics, the AI tools used in apparel quality monitoring, and their applications in real-time production environments.
2. Explain the process of using AI-enabled systems to monitor production quality, track key performance indicators (KPIs), and generate quality reports and visual dashboards.
3. Discuss the interpretation of AI-generated quality data to identify defect trends, production bottlenecks, process deviations, and recurring quality issues.
4. Highlight the role of AI-based monitoring systems in improving product quality, reducing defects, enhancing operational efficiency, and ensuring compliance with quality standards.
5. Outline the procedures for implementing corrective and preventive actions based on AI-driven insights, coordinating with production and quality teams, and using predictive analytics to prevent future quality issues.

UNIT 5.1: AI-Powered Quality Analysis and Improvement

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe AI-based analytics, quality monitoring tools, and their role in real-time production.
2. Explain how AI systems monitor quality, measure KPIs, and generate reports and dashboards.
3. Discuss how AI-generated data identifies defect trends, process variations, and quality issues.
4. Highlight how AI-based systems improve quality, reduce defects, and enhance efficiency.
5. Outline the use of AI-driven insights for corrective and preventive actions.

5.1.1 AI-Based Analytics and Monitoring Tools

AI-based analytics and monitoring tools use artificial intelligence to collect, analyse, and interpret production and quality data for real-time apparel quality monitoring. These tools help apparel quality analysts identify defects, monitor production performance, predict quality issues, and improve quality decisions.

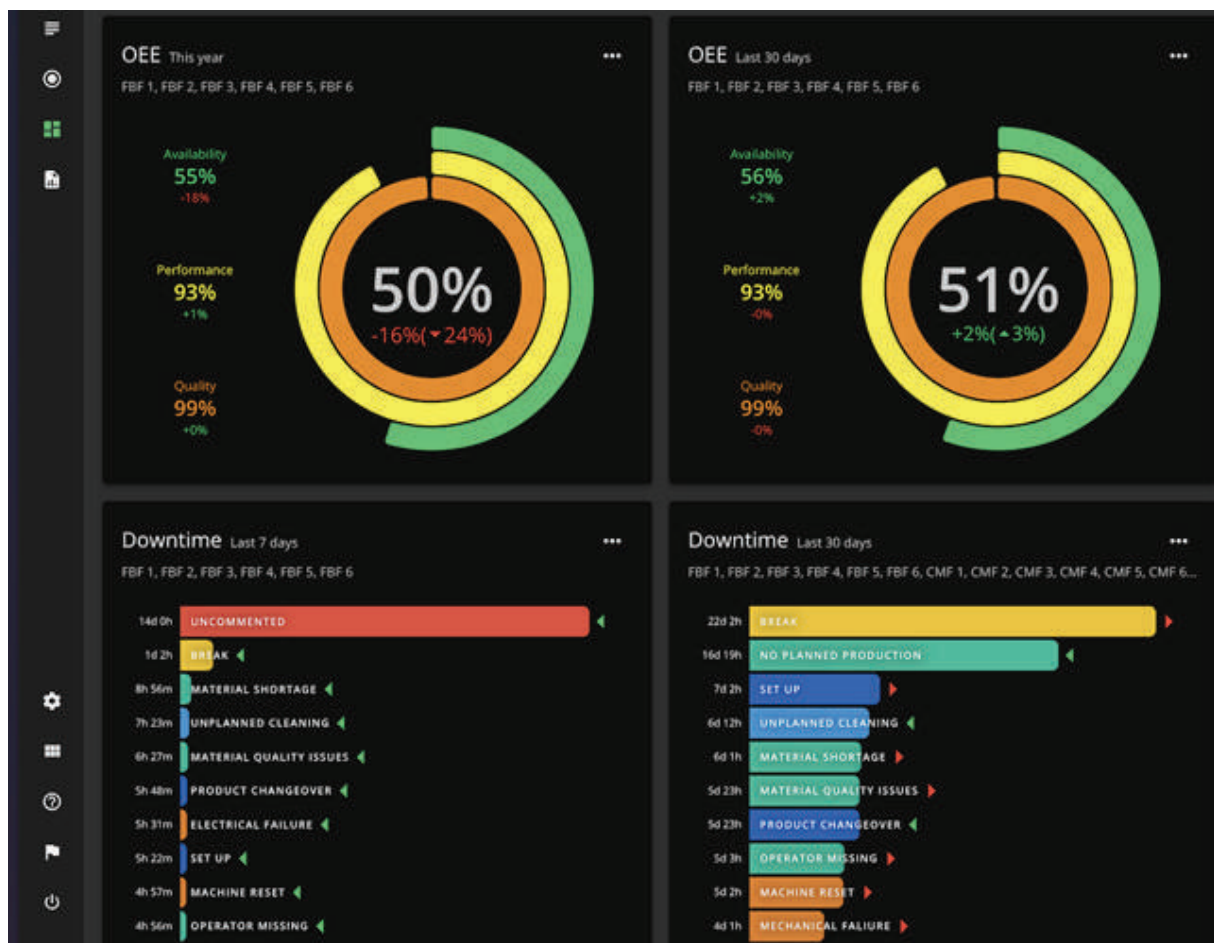


Fig. 5.1.1: AI-based analytics and monitoring tools dashboard sample

The following are the five main AI-based analytics and monitoring tools used in apparel production:

- **AI-based production analytics tools**

AI-based production analytics tools analyse production output, line efficiency, machine utilisation, and operator performance to identify productivity trends and process variations. The Ministry of Textiles promotes digital manufacturing technologies that support AI-based production monitoring.

- **AI-based quality monitoring tools**

AI-based quality monitoring tools analyse inspection data, defect rates, DHU, FPY, and rejection trends to monitor production quality in real time. Government-supported textile modernisation programmes encourage industries to adopt AI-enabled quality monitoring systems.

- **AI-based predictive analytics tools**

AI-based predictive analytics tools analyse historical production and inspection data to predict defects, quality risks, and process failures before they occur. Smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) promote predictive AI technologies.

- **AI-based visual monitoring tools**

AI-based visual monitoring tools use computer vision to detect fabric, stitching, measurement, and finishing defects automatically during production. Digital manufacturing initiatives supported by the Ministry of Textiles promote automated visual inspection technologies.

- **AI-based production dashboards**

AI-based production dashboards display real-time production, inspection, and quality KPIs through interactive visual reports for production monitoring. Government initiatives such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote AI-enabled dashboards for continuous quality monitoring.

5.1.2 AI-Enabled Production Quality Monitoring

AI-enabled production quality monitoring uses Artificial Intelligence (AI), computer vision, machine learning, and digital analytics to continuously monitor product quality during apparel manufacturing. These systems collect and analyse production and inspection data in real time to detect defects, monitor quality performance, identify process deviations, and generate quality alerts. Through interactive digital dashboards, they enable apparel quality analysts to make timely quality decisions, minimise defects, reduce rework and rejection, and ensure compliance with quality standards throughout the production process.

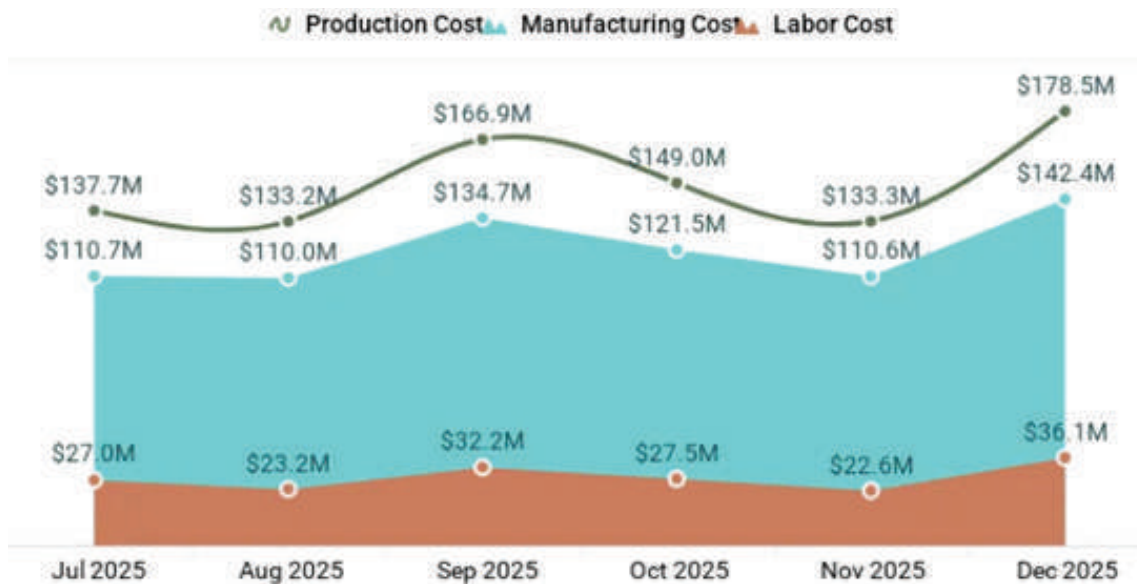


Fig. 5.1.2: AI-enabled production quality monitoring dashboard sample

The following are the main AI tools and software used for real-time quality tracking:

- **AI quality inspection software**

AI quality inspection software uses computer vision to detect fabric, stitching, measurement, and finishing defects automatically. The Ministry of Textiles promotes AI-enabled inspection technologies through digital manufacturing initiatives.

- **AI production monitoring software**

AI production monitoring software monitors production output, line efficiency, machine utilisation, and operator performance in real time. Smart manufacturing initiatives encourage the adoption of AI-based production monitoring systems.

- **AI defect analytics software**

AI defect analytics software analyses defect trends and inspection data to identify root causes and recommend corrective actions. The National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) promotes AI-based quality analytics.

- **AI quality dashboard software**

AI quality dashboard software displays real-time quality KPIs, including DHU, FPY, defect rate, rejection rate, and rework. Textile modernisation initiatives encourage the use of digital dashboards for continuous quality monitoring.

- **AI predictive quality software**

AI predictive quality software analyses production and inspection data to predict quality risks before defects occur. SAMARTH (Scheme for Capacity Building in Textile Sector) promotes awareness of AI-enabled predictive quality systems.

The following are some of the commonly used AI-enabled production quality monitoring systems in apparel manufacturing:

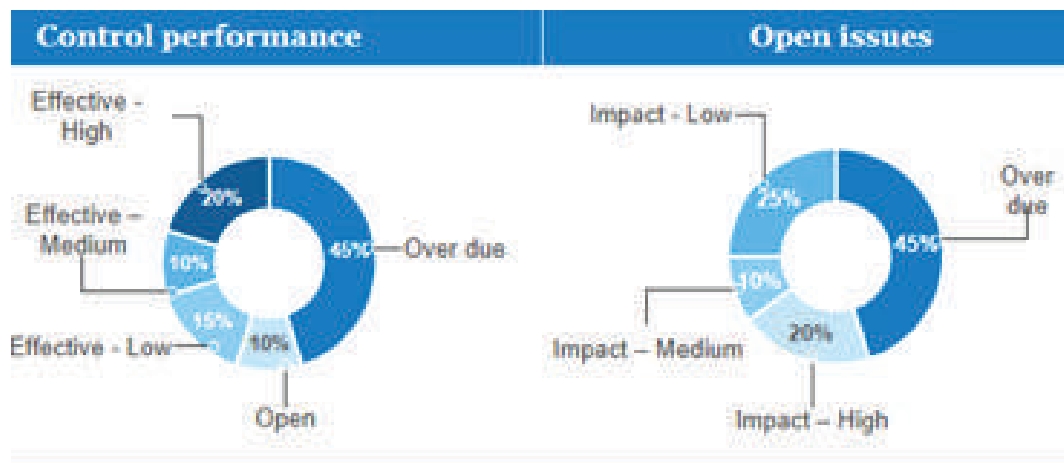
AI production quality monitoring tool	Digital quality monitoring dashboard	Quality parameters monitored	Purpose in quality monitoring	Application by Apparel Quality Analyst
Lectra Fashion on Demand	Production Quality Dashboard	Defect trends, garment quality status, line quality, inspection results, quality alerts	Continuously monitors production quality and identifies quality issues during garment manufacturing.	Monitors real-time production quality, tracks quality alerts, identifies defect patterns, and coordinates corrective actions with production teams.
Coats Digital GSDCost	Quality Performance Dashboard	DHU, FPY, operator quality performance, rework rate, quality trends	Monitors quality performance and identifies opportunities to improve production quality and reduce defects.	Reviews quality KPIs, evaluates operator performance, analyses rework trends, and recommends process improvements.
Siemens Opcenter Quality	Quality Monitoring Dashboard	Inspection records, non-conformities, CAPA status, process capability, audit findings	Tracks quality compliance, monitors inspection outcomes, and supports corrective and preventive actions.	Monitors inspection records, tracks CAPA implementation, verifies process compliance, and follows up on non-conformities.
SAP Digital Manufacturing	Manufacturing Quality Dashboard	OEE, defect rate, production yield, quality alerts, rejection trends	Provides real-time visibility of manufacturing quality and supports timely quality interventions.	Reviews quality dashboards, monitors production quality metrics, investigates quality alerts, and supports timely quality decisions.
AVEVA MES	Quality Intelligence Dashboard	Quality KPIs, rejection trends, process deviations, inspection status, traceability data	Continuously monitors manufacturing quality and provides insights for process improvement.	Tracks quality KPIs, monitors process deviations, verifies product traceability, and supports continuous quality improvement.

AI production quality monitoring tool	Digital quality monitoring dashboard	Quality parameters monitored	Purpose in quality monitoring	Application by Apparel Quality Analyst
PTC ThingWorx	AI Quality Monitoring Dashboard	Machine quality alerts, process deviations, quality events, equipment condition	Uses AI and IoT analytics to monitor production quality and identify potential quality risks before defects occur.	Monitors AI-generated quality alerts, identifies potential quality risks, and initiates preventive actions before defects escalate.
Microsoft Power BI (Quality Analytics)	Interactive Quality Dashboard	DHU, FPY, defect Pareto charts, rejection trends, operator quality performance	Visualises quality performance through interactive dashboards to support quality monitoring and decision-making.	Analyses quality trends, prepares dashboard reports, performs Pareto analysis, and presents quality insights to management.
Tableau Quality Analytics	Quality Performance Dashboard	Defect distribution, inspection trends, quality KPIs, line-wise quality performance	Converts inspection and production quality data into dashboards for continuous quality monitoring and performance analysis.	Visualises production quality data, compares line-wise performance, identifies recurring quality issues, and supports data-driven quality improvement.

Table 5.1.1: AI-enabled production quality monitoring tools and dashboards

5.1.3 AI-Generated Quality Data Analysis

AI-generated quality data analysis uses artificial intelligence to analyse production and quality data for improved decision-making, defect reduction, and product quality.



Operational risk		
RISK NAME	SCORE	TREND
Cost Cutting	High	●
Organization Change	High	●
Emergency Technologies	Medium	●
Taxation Risk	Low	●
Add text here	Low	●
Add text her	High	●

Fig. 5.1.3: AI-based quality data analysis dashboard sample

The following are the main applications of AI-generated quality data analysis:

- **Product quality improvement**

AI analyses inspection data and quality parameters to identify deviations and improve garment quality. The Ministry of Textiles promotes AI-enabled quality improvement through digital manufacturing initiatives.

- **Defect reduction analysis**

AI analyses defect trends and frequencies to identify recurring issues and support corrective actions. Smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) support AI-based defect analytics.

- **Operational efficiency analysis**

AI analyses production, machine, and operator data to identify bottlenecks and improve efficiency. Government-supported digital manufacturing programmes encourage AI integration to improve operational efficiency.

- **Predictive quality analysis**

AI analyses historical production and inspection data to predict quality risks and prevent defects. The Ministry of Textiles promotes predictive AI technologies for quality assurance and process optimisation.

- **Quality performance analysis**

AI analyses quality KPIs such as DHU, FPY, defect rate, rejection rate, and rework to monitor performance and support continuous improvement. Government initiatives such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote AI-driven quality analysis for apparel manufacturing.

5.1.4 AI-Based Quality Monitoring Benefits

data, and improve quality compliance, defect control, and continuous improvement.

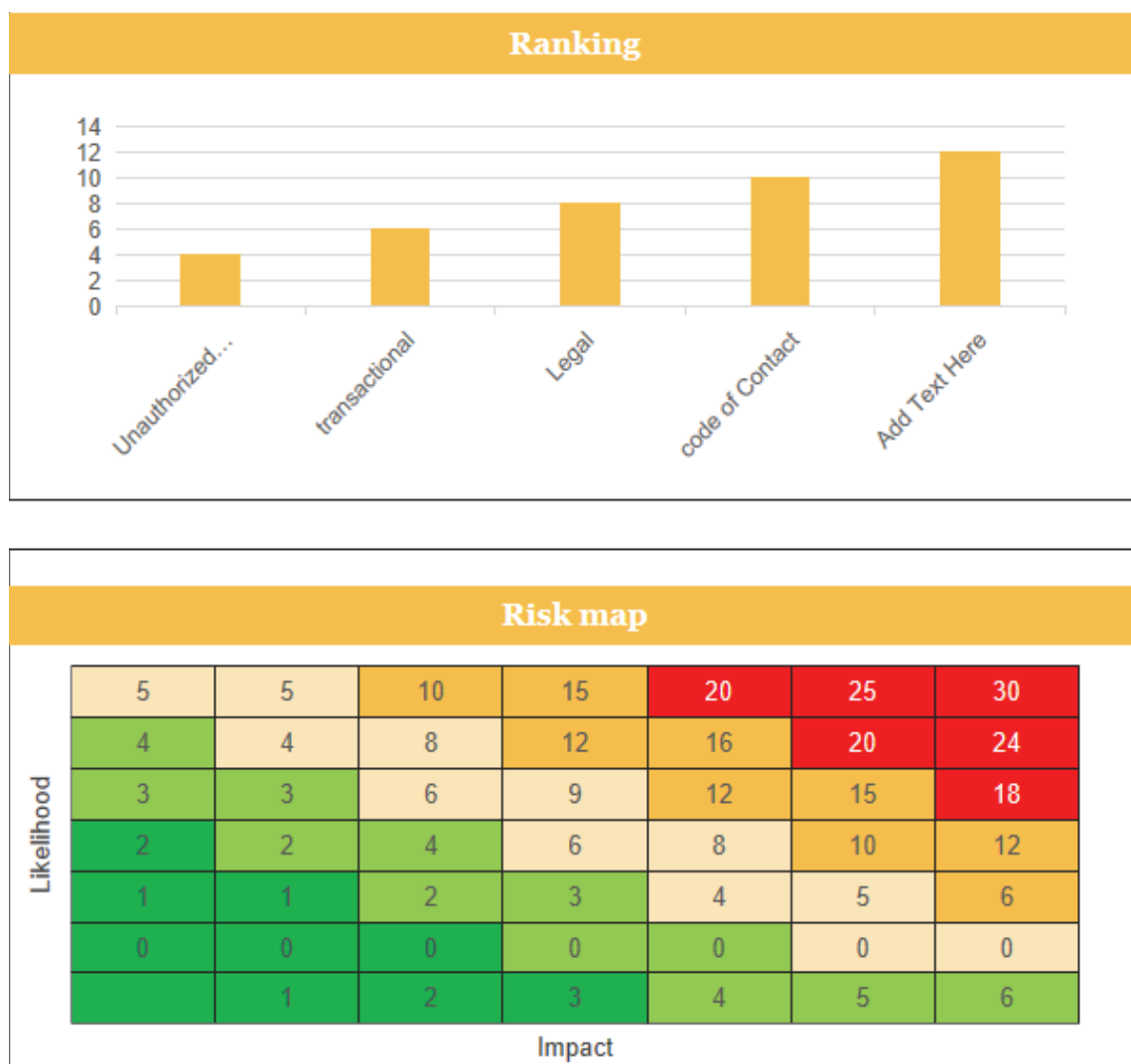


Fig. 5.1.4: AI-based quality monitoring sample dashboard

The following are the main benefits of AI-based quality monitoring:

- **Quality standards compliance**

AI compares inspection and production data with buyer specifications, organisational procedures, and regulatory quality standards to identify non-conformities and recommend corrective actions. The Ministry of Textiles promotes AI-enabled quality systems to strengthen compliance in apparel manufacturing.

- **Improved defect control**

AI monitors quality data in real time to identify recurring defects and recommend corrective and preventive actions for defect reduction. Smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) support AI-based quality improvement.

- **Production and quality coordination**

AI shares production insights, quality trends, and defect reports with production and quality teams to support timely corrective actions and process improvements. Government-supported digital manufacturing programmes encourage integrated AI-based quality management.

- **Operational efficiency improvement**

AI analyses production performance, machine utilisation, and inspection data to improve productivity, optimise resources, and reduce process variations. The Ministry of Textiles promotes AI integration for efficient apparel manufacturing.

- **Continuous quality improvement**

AI analyses quality KPIs, production performance, and inspection trends to support continuous monitoring and long-term quality improvement. Government initiatives such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote AI-enabled quality monitoring for sustainable manufacturing excellence.

5.1.5 AI-Driven Corrective Preventive Actions

AI-driven corrective and preventive actions use artificial intelligence to analyse quality data, predict defects, and recommend actions to improve process effectiveness and quality compliance.

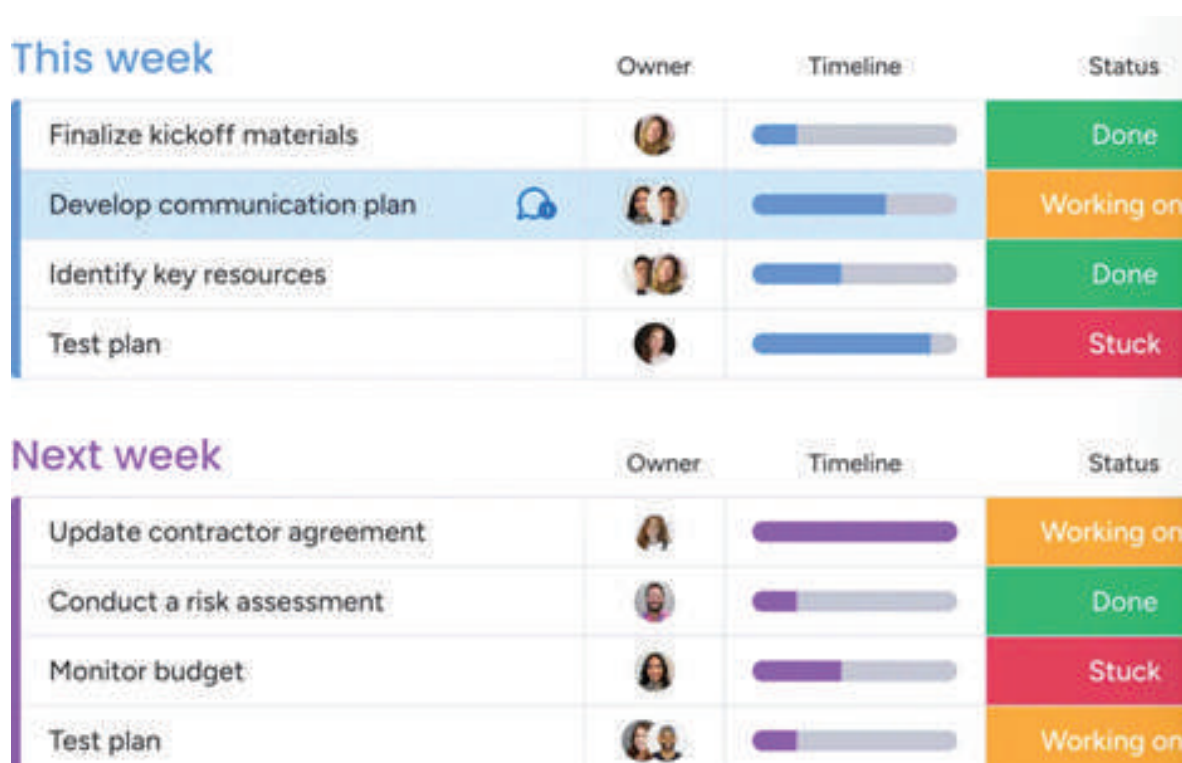


Fig. 5.1.5: AI-based corrective preventive action dashboard sample

The following are the main applications of AI-driven corrective and preventive actions:

- **Defect rate monitoring**

AI monitors defect rates, defect types, and recurring quality issues to identify process variations and recommend corrective actions. The Ministry of Textiles promotes AI-enabled quality monitoring through digital manufacturing initiatives.

- **Compliance monitoring**

AI tracks compliance with buyer specifications, organisational procedures, and regulatory quality standards by analysing production and inspection data. Government-supported digital quality programmes encourage AI-based compliance monitoring systems.

- **Process effectiveness analysis**

AI analyses production efficiency, machine performance, operator productivity, and inspection results to evaluate process effectiveness and recommend improvements. Smart manufacturing initiatives under the National Mission on Interdisciplinary Cyber-Physical Systems (NM-ICPS) support AI-driven process optimisation.

- **Predictive quality analysis**

AI analyses historical production and inspection data to predict potential quality issues, process deviations, and defect trends before they occur. Government-supported AI initiatives encourage predictive quality management for apparel manufacturing.

- **Preventive action planning**

AI generates preventive action recommendations by analysing defect patterns, quality KPIs, and production trends to minimise future quality issues. Government initiatives such as SAMARTH (Scheme for Capacity Building in Textile Sector) promote AI-enabled preventive quality management and continuous improvement.

Summary

- AI-based analytics helps monitor apparel quality by collecting, analysing, and interpreting production and inspection data in real time.
- AI-driven systems capture and track production quality metrics to support timely quality monitoring and decision-making.
- AI tools and software automatically identify garment defects, quality deviations, and recurring defect patterns during production.
- AI-generated data helps identify production bottlenecks, process variations, and root causes of quality issues.
- AI-based monitoring systems improve product quality by reducing defects and enhancing operational efficiency.
- Industry quality standards and compliance requirements guide the implementation of AI-enabled quality monitoring systems.
- AI-generated reports provide structured information that supports quality analysis and continuous process improvement.
- Interactive dashboards present real-time quality data, defect trends, and key performance indicators for effective monitoring.
- Corrective and preventive actions can be implemented using insights generated through AI-based quality analytics.
- AI-based monitoring systems can be integrated with conventional quality assurance methods to improve manufacturing efficiency.
- Key performance indicators such as defect rates, compliance status, and process effectiveness can be monitored using AI tools.
- AI-driven insights support informed decision-making, management review, and proactive quality improvement in apparel manufacturing.

Exercise

Multiple-choice Question:

1. What is the primary purpose of AI-based analytics in apparel quality monitoring?
 - a. To monitor apparel quality and identify production issues
 - b. To increase manual paperwork
 - c. To reduce garment production speed
 - d. To replace garment packaging

2. Which AI-based tool is commonly used for real-time quality tracking in apparel manufacturing?
 - a. Digital quality dashboard
 - b. Measuring tape
 - c. Packing list
 - d. Delivery challan

3. Why do quality teams analyse AI-generated production data?
 - a. To identify defect trends and quality deviations
 - b. To increase production costs
 - c. To reduce machine maintenance
 - d. To avoid quality inspections

4. What is a key benefit of AI-based quality monitoring systems?
 - a. They help reduce defects and improve compliance with quality standards.
 - b. They eliminate the need for production planning.
 - c. They increase raw material consumption.
 - d. They replace all quality inspectors completely.

5. What is the purpose of AI-generated reports and dashboards in apparel manufacturing?
 - a. To support data-driven quality decisions and corrective actions
 - b. To increase garment packaging time
 - c. To replace production schedules
 - d. To reduce communication between production teams

Descriptive Questions:

1. Explain the role and importance of digital and AI-enabled tools in apparel quality assurance and production monitoring.
2. Describe the applications of AI-based inspection systems and digital dashboards in detecting garment defects and monitoring production quality.
3. Explain how AI-generated production data and quality reports help identify defect trends and determine root causes.
4. Describe the benefits of AI-integrated quality assurance systems and AI-driven corrective and preventive actions in improving product quality.
5. Explain the importance of preparing data-driven quality reports and integrating AI-enabled tools with conventional inspection processes to improve manufacturing efficiency.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/-O5aqZ55QR8>

AI-generated quality data analysis





6. Apply Quality Control Tools and Techniques

Unit 6.1 - Quality Control Analysis Techniques

Unit 6.2 - Quality Improvement Documentation Practices



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Explain the fundamental concepts, principles, and significance of quality control (QC) in apparel production.
2. Describe the purpose and applications of Root Cause Analysis (RCA) and quality control tools such as Ishikawa diagrams, Pareto charts, histograms, control charts, scatter diagrams, check sheets, and flow charts.
3. Discuss quality improvement methodologies, including DMAIC, SIPOC, FMEA, 5S, and Kaizen, for systematic process improvement and defect prevention.
4. Interpret production and inspection data to identify defects, trends, process variations, and deviations from quality standards.
5. Compare process capability metrics (Cp/Cpk) with quality specifications to evaluate process performance and compliance.
6. Prepare check sheets, flow charts, standardised inspection formats, and quality records to support effective quality monitoring and documentation.
7. Elaborate on corrective and preventive action (CAPA) plans using insights obtained from quality control tools and defect analysis.
8. Highlight quality control techniques to investigate root causes, prioritise defects, and improve process stability and production quality.
9. Highlight the importance of continuous quality improvement practices and quality control methodologies in enhancing product quality, operational efficiency, and customer satisfaction.

UNIT 6.1: Quality Control Analysis Techniques

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the basic concepts, principles, and importance of quality control (QC) in apparel manufacturing.
2. Describe the purpose and applications of Root Cause Analysis (RCA) and quality control tools, including Ishikawa diagrams, Pareto charts, histograms, control charts, scatter diagrams, check sheets, and flow charts.
3. Outline production and inspection data to identify defects, trends, process variations, and non-conformities with quality standards.
4. Compare process capability indices (Cp/Cpk) with quality specifications to assess process performance and compliance.

6.1.1 Quality Control Concepts and Principles

Quality control (QC) is the process of inspecting and monitoring materials, production processes, and finished garments to ensure they meet specified quality standards. It helps apparel quality analysts identify defects early, maintain consistent product quality, and satisfy buyer requirements.



Fig. 6.1.1: Quality control pillars

The following are the main quality control concepts and principles used in the apparel industry:

- **Quality inspection**
Quality inspection systematically examines materials and garments to detect defects and verify compliance with quality specifications.
- **Process control**
Process control monitors production processes to maintain consistency, minimise variations, and ensure uniform quality.
- **Defect prevention**
Defect prevention identifies potential quality issues early to eliminate defects before production progresses.
- **Quality standards compliance**
Quality standards compliance verifies garments against approved specifications, procedures, and regulatory requirements.
- **Continuous quality improvement**
Continuous quality improvement uses inspection data and corrective actions to enhance quality performance and reduce recurring defects.

6.1.2 Root Cause Analysis Quality Tools

What is root cause analysis (RCA)?

Root cause analysis systematically identifies the underlying causes of quality defects to eliminate recurring issues and improve product quality.

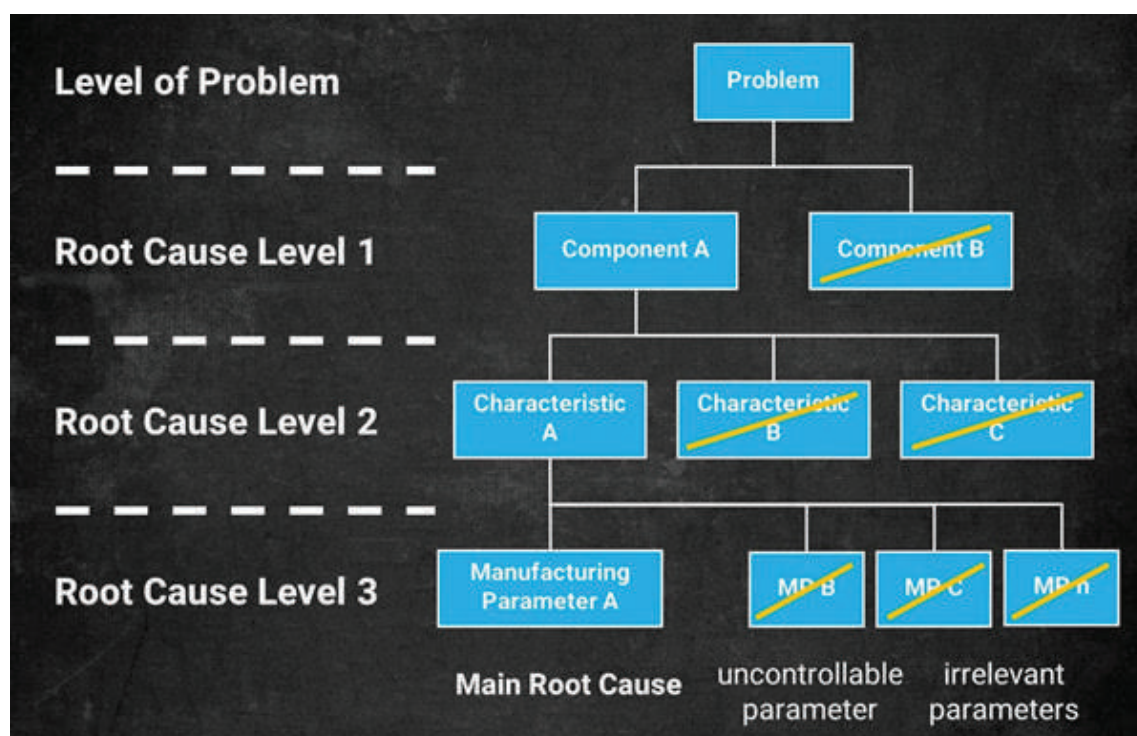


Fig. 6.1.2: RCA components and levels

Steps of doing RCA:

The following are the key stages of root cause analysis used in apparel quality assurance:

- Defect data analysis**
 Defect data analysis involves collecting and analysing defect type, frequency, location, and occurrence to identify recurring quality problems. The apparel quality analyst reviews inspection records and defect trends to determine the probable root causes.
- Process flow analysis**
 Process flow analysis involves examining each production stage, from fabric inspection to packing, to identify where quality deviations occur. The apparel quality analyst analyses process sequences, machine settings, and work methods to locate the source of defects.
- Operator feedback analysis**
 Operator feedback analysis involves collecting information from machine operators and supervisors regarding production issues, machine performance, and working methods. The apparel quality analyst uses this feedback to verify root causes and recommend effective corrective and preventive actions.
- Isolate systemic issues**
 Systemic issue identification involves analysing defect data, process flows, and operator feedback together to identify recurring issues affecting the overall production system. The apparel quality analyst isolates systemic issues, confirms the root causes, and recommends long-term corrective and preventive measures to improve process stability.

Root cause analysis tools

Root cause analysis (RCA) tools are structured methods used to identify, analyse, and verify the underlying causes of quality defects and production problems in apparel manufacturing. They help apparel quality analysts systematically investigate issues, isolate root causes, and implement effective corrective and preventive actions. One such tool is;

- Ishikawa (Fishbone) Diagrams**
 Cause-and-Effect (Ishikawa) diagrams systematically identify and organise the root causes of quality defects to support effective corrective and preventive actions.

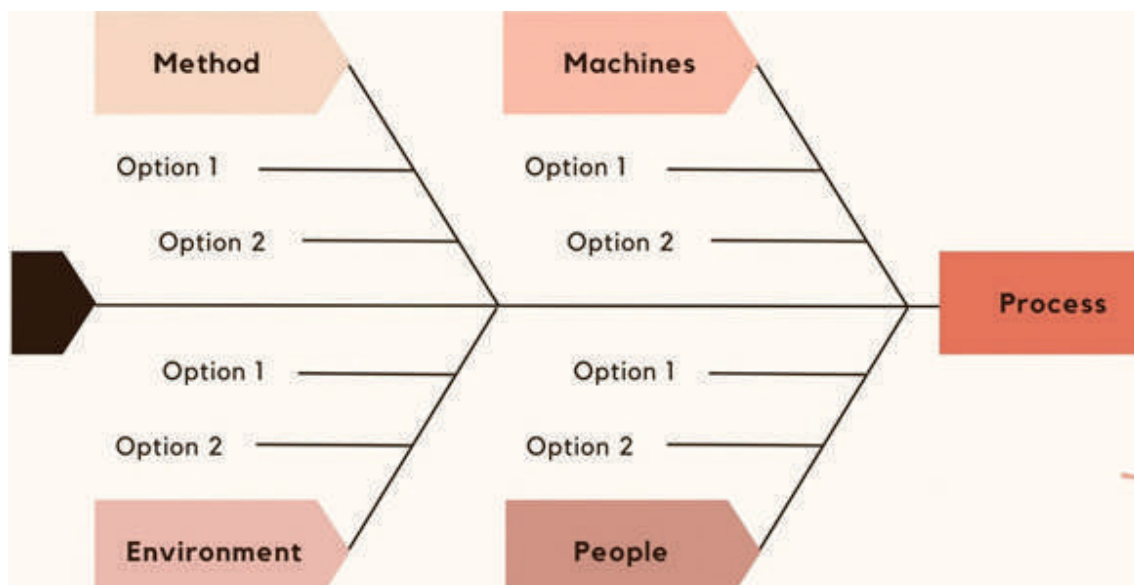


Fig. 6.1.3: Ishikawa (Fishbone) diagram sample

The following are the stages of using Ishikawa diagrams for garment defect analysis:

- **Defect identification**

Defect identification involves recognising and defining the critical garment defect through inspection and quality records. For example, the apparel quality analyst identifies recurring seam puckering in T-shirts during end-line inspection and writes the defect at the head of the Ishikawa diagram as the problem to be investigated.

- **Data collection**

Data collection involves gathering defect reports, production records, process flow details, and operator feedback related to the defect. The apparel quality analyst records the collected information under the relevant Man, Machine, Material, Method, Measurement, and Environment branches of the Ishikawa diagram.

- **Cause-and-effect analysis**

Cause-and-effect analysis involves examining all possible causes under the six Ishikawa categories to identify the most likely source of the defect. For example, the apparel quality analyst lists incorrect thread tension under Machine, unsuitable fabric under Material, and improper sewing method under Method, then analyses each branch to narrow down the possible causes.

- **Root cause verification**

Root cause verification involves confirming the actual cause through production trials, inspections, and process checks. The apparel quality analyst tests the suspected causes identified in the Ishikawa diagram and confirms that incorrect thread tension under the Machine branch is the root cause after adjusting the settings removes the seam puckering.

- **Corrective and preventive action**

Corrective and preventive action involves implementing measures to eliminate the confirmed root cause and prevent recurrence. The apparel quality analyst updates the Ishikawa diagram with the verified root cause and corresponding corrective actions, such as standardising thread tension settings, retraining operators, and strengthening machine maintenance procedures for future production.

6.1.3 Production Inspection Data Analysis

What is Production Inspection Data?

Production inspection data is the information collected during quality inspections at different stages of apparel production, including fabric inspection, cutting, stitching, finishing, and final inspection. It helps the apparel quality analyst monitor product quality, analyse defects, evaluate production performance, and support corrective and preventive actions.

Production inspection data analysis

Production inspection data analysis is the process of analysing inspection data collected during apparel production to identify defect patterns, evaluate quality performance, and support quality improvement. It helps the apparel quality analyst prioritise high-frequency defects, determine corrective actions, and improve production efficiency and compliance with quality standards. The following are the different methods of doing production inspection data analysis:

- **Pareto charts**

Pareto charts arrange garment defects from the highest to the lowest frequency, helping the apparel quality analyst prioritise high-frequency defects for corrective action. For example, if seam puckering occurs most frequently, it is addressed first to achieve the maximum improvement in garment quality.

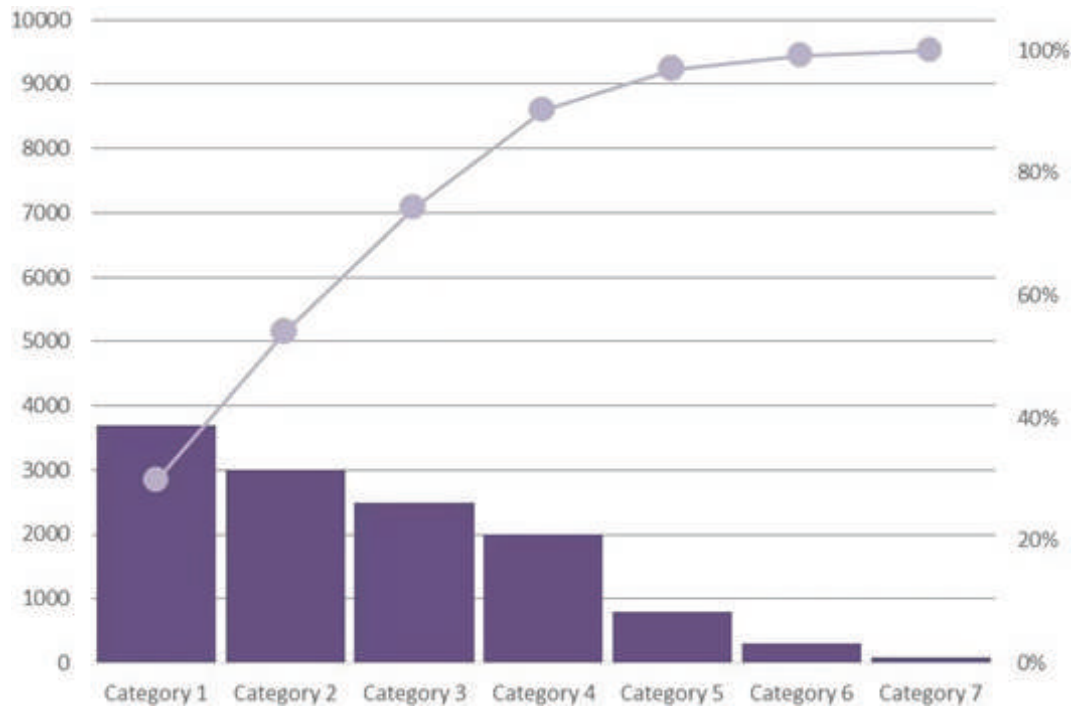


Fig. 6.1.4: Pareto chart sample

- **Histogram**

Histograms show the frequency distribution of quality data, helping the apparel quality analyst assess process stability and variation by identifying whether measurements or defects are consistently distributed. For example, the analyst plots garment chest measurements to verify that most garments fall within the specified measurement tolerance.

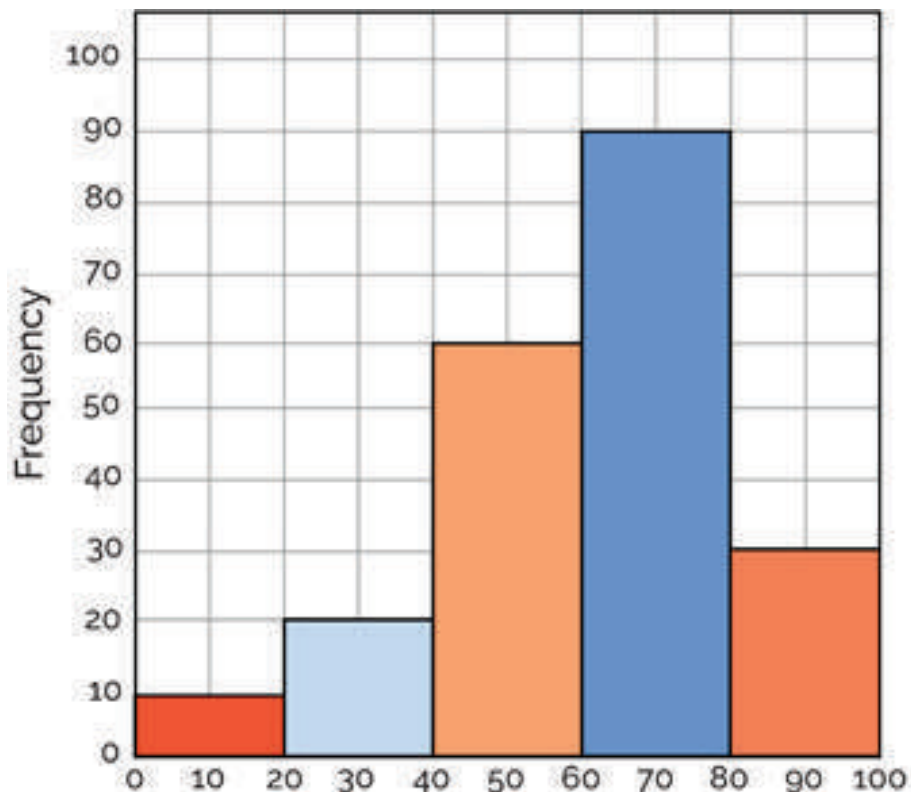


Fig. 6.1.5: Histogram sample

- Control charts**

Control charts display quality data over time against upper and lower control limits, helping the apparel quality analyst assess process stability and detect abnormal process variations requiring corrective action. For example, the analyst monitors hourly DHU values to determine whether the sewing process remains under statistical control throughout production.

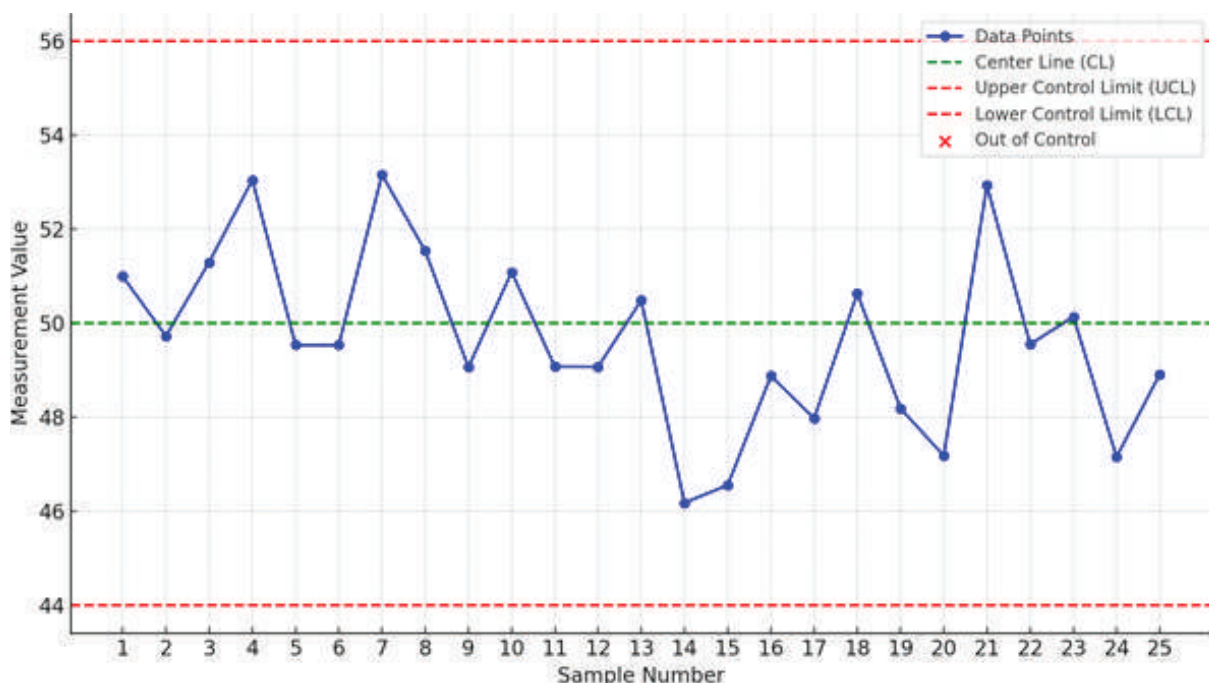


Fig. 6.1.7: Control chart sample

- **Scatter diagrams**

Scatter diagrams display the relationship between two quality-related variables, helping the apparel quality analyst examine relationships such as machine type versus defect rate or machine speed versus stitch defects. For example, the analyst compares different sewing machine models with skipped stitch rates to identify whether a particular machine type produces more defects.

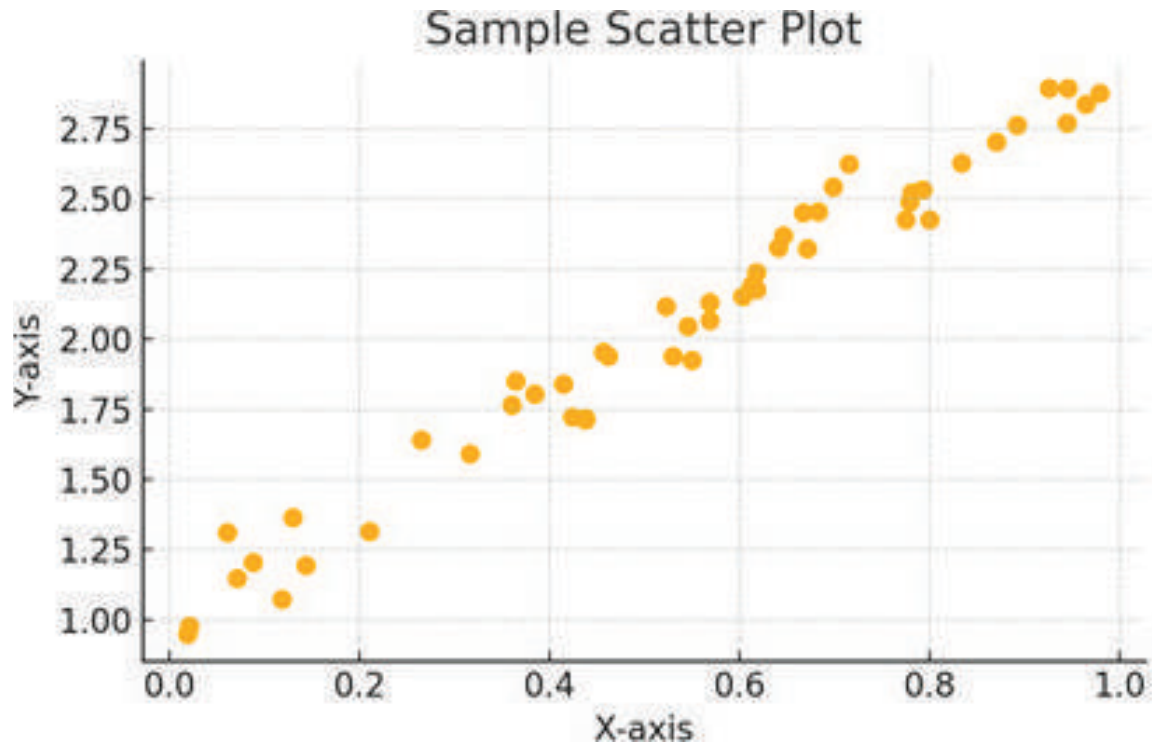


Fig. 6.1.8: Scatter diagram

6.1.4 Process Capability Performance Assessment

What is process capability?

Process capability performance is the ability of a production process to consistently produce garments that meet specified quality standards and measurement tolerances. It helps the apparel quality analyst evaluate whether the production process is stable, capable, and able to produce defect-free garments consistently.

What is process capability performance assessment?

Process capability performance assessment is the process of evaluating how consistently a production process meets specified quality standards and measurement tolerances over time. It helps the apparel quality analyst analyse process performance, identify variations, and determine whether corrective actions are needed to maintain consistent garment quality.

Parameters for process capability performance assessment

Parameters for process capability performance assessment are the quality and process indicators used to evaluate whether a production process consistently meets specified standards and performance requirements. They help the apparel quality analyst measure process stability, identify variations, and determine the capability of the production process to produce conforming garments consistently.

Process capability metrics (Cp/Cpk):

Process capability metrics are measurable indicators used to evaluate how consistently a production process meets specified quality standards and performance requirements.

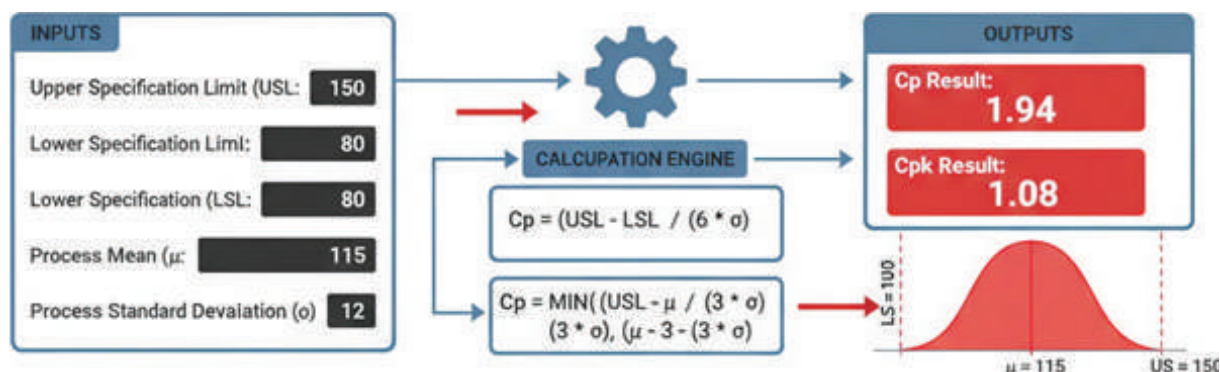


Fig. 6.1.9: Process quality metrics sample interaction

Process capability metrics help the apparel quality analyst assess process stability, capability, and compliance with garment specifications. They are as follows:

- Cp**
 Process capability index (Cp) measures the potential capability of an apparel production process to produce garments within specified quality limits, assuming the process is centred. It is calculated as $Cp = (USL - LSL) \div 6\sigma$, where USL is the Upper Specification Limit, LSL is the Lower Specification Limit, and σ is the process standard deviation.
- Cpk**
 Process capability performance index (Cpk) measures the actual capability of an apparel production process by considering both process variation and process centring within specified quality limits. It is calculated as $Cpk = \min [(USL - \mu) \div 3\sigma, (\mu - LSL) \div 3\sigma]$, where μ is the process mean, USL is the Upper Specification Limit, LSL is the Lower Specification Limit, and σ is the process standard deviation.

Stages of process capability performance assessment

The following are the stages of process capability performance assessment using Process Capability Index (Cp) and Process Capability Performance Index (Cpk):

- Define quality specifications**
 The apparel quality analyst identifies the quality characteristic and establishes the Upper Specification Limit (USL) and Lower Specification Limit (LSL) from the buyer's specifications. Example: Garment chest measurement 100 ± 2 cm, where USL = 102 cm and LSL = 98 cm.
- Collect production measurements**
 The apparel quality analyst measures production samples and calculates the process mean (μ) and standard deviation (σ). Example: From 100 garments, $\mu = 100.5$ cm and $\sigma = 0.40$ cm.
- Calculate Process Capability Index (Cp)**
 The apparel quality analyst calculates $Cp = (USL - LSL) \div 6\sigma$ to assess the potential process capability. Example: $Cp = (102 - 98) \div (6 \times 0.40) = 1.67$, indicating the process is capable of meeting specifications.

- **Calculate Process Capability Performance Index (Cpk)**

The apparel quality analyst calculates $Cpk = \min [(USL - \mu) \div 3\sigma, (\mu - LSL) \div 3\sigma]$ to assess the actual process capability. Example: $Cpk = \min [(102 - 100.5) \div 1.20, (100.5 - 98) \div 1.20] = 1.25$, indicating the process is capable but slightly off-centre.

- **Interpret results**

The apparel quality analyst compares the C_p and C_{pk} values with the acceptance criteria to determine process capability. Generally, $C_p/C_{pk} \geq 1.33$ indicates a capable process, while lower values require corrective actions to improve quality consistency.

UNIT 6.2: Quality Improvement Documentation Practices

Unit Objectives

By the end of this unit, the participants will be able to:

1. Discuss quality improvement approaches such as DMAIC, SIPOC, FMEA, 5S, and Kaizen for process improvement and defect prevention.
2. Prepare check sheets, flow charts, standardised inspection formats, and quality records for effective quality monitoring and documentation.
3. Elaborate on corrective and preventive action (CAPA) plans using findings from quality control tools and defect analysis.
4. Highlight quality control techniques for investigating root causes, prioritising defects, and improving process stability and product quality.
5. Highlight the importance of continuous quality improvement practices and quality control methodologies in improving product quality, operational efficiency, and customer satisfaction.

6.2.1 Quality Improvement Methods and Frameworks

What is a quality improvement method?

Quality improvement method is a systematic approach used to identify, analyse, and eliminate quality issues to improve garment production processes and product quality. It helps the apparel quality analyst reduce defects, improve process efficiency, and achieve consistent compliance with buyer quality standards.

- **DMAIC**

DMAIC (Define, Measure, Analyse, Improve, Control) is a quality improvement method used to systematically identify production problems, analyse their causes, implement improvements, and sustain process performance in apparel manufacturing. It helps the apparel quality analyst reduce defects, improve process capability, and maintain consistent garment quality.

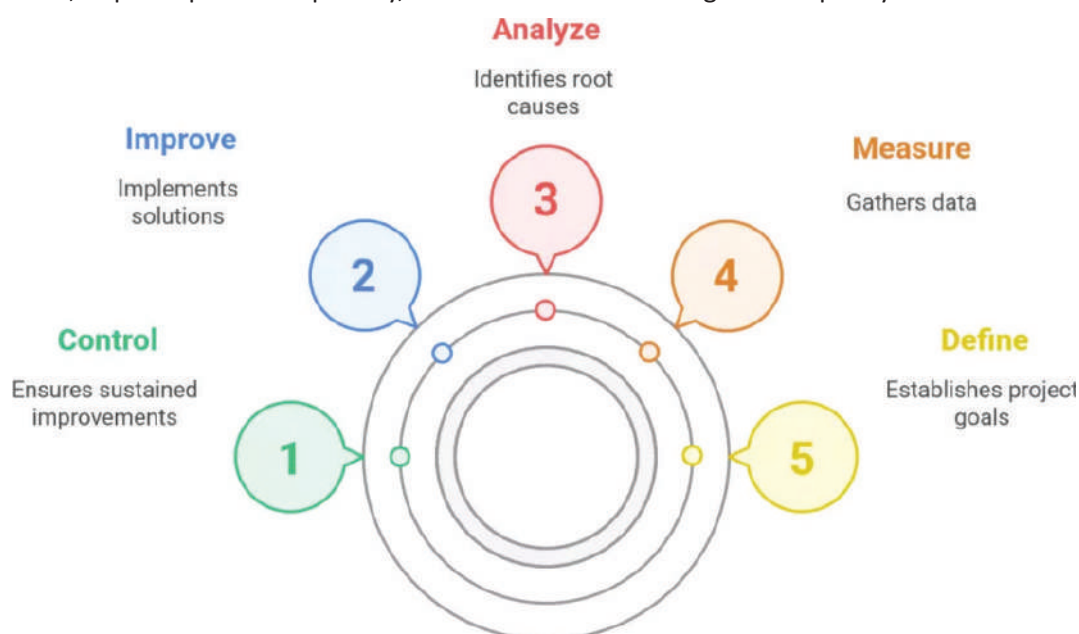


Fig. 6.2.1: DMAIC sample diagram

The following are the stages of the DMAIC cycle used to eliminate chronic defects and stabilise garment production:

- **Define**
The apparel quality analyst defines the quality problem, objectives, and process for improvement. For example, recurring seam puckering is identified as the critical defect.
- **Measure**
The apparel quality analyst collects production and inspection data to measure current process performance. For example, DHU, defect frequency, and garment measurements are recorded.
- **Analyse**
The apparel quality analyst analyses defect data and process conditions to identify the root cause. For example, incorrect thread tension is confirmed as the cause of seam puckering.
- **Improve**
The apparel quality analyst implements corrective actions to eliminate the root cause. For example, thread tension is adjusted and operators are retrained.
- **Control**
The apparel quality analyst monitors quality KPIs and inspection results to sustain the improvements. For example, daily DHU monitoring confirms consistent seam quality.

What is a quality assessment framework?

Quality assessment framework is a structured system used to evaluate garment quality by defining inspection criteria, quality parameters, performance indicators, and compliance requirements. It helps the apparel quality analyst assess production quality consistently, monitor performance, and ensure garments meet buyer and organisational standards.

- **SIPOC Diagrams**

SIPOC (Suppliers, Inputs, Process, Outputs, Customers) diagrams are quality improvement frameworks used to map the complete apparel production process from suppliers to customers. They help the apparel quality analyst understand process flow, identify quality checkpoints, and improve production efficiency and quality control.



Fig. 6.2.2: SIPOC diagram sample

The following are the stages of a SIPOC diagram used to map the apparel production process and define cross-departmental requirements:

- **Suppliers**

The apparel quality analyst identifies the suppliers' providing fabrics, trims, accessories, and other production inputs. For example, approved fabric and trim vendors are listed as suppliers.

- **Inputs**

The apparel quality analyst identifies the materials, documents, and resources required for production. For example, fabrics, sewing threads, patterns, trim cards, and measurement charts are identified as inputs.

- **Process**

The apparel quality analyst maps the major production stages from cutting to final inspection. For example, cutting, stitching, finishing, inspection, and packing are listed as the process steps.

- **Outputs**

The apparel quality analyst identifies the products or results generated by the process. For example, approved finished garments packed as per buyer specifications are identified as outputs.

- **Customers**

The apparel quality analyst identifies the internal or external customers receiving the outputs. For example, buyers, exporters, retailers, or end customers are identified as the customers.

6.2.2 Quality Monitoring Documentation Records

Quality monitoring documentation records capture inspection findings, defect details, and quality data to ensure traceability, compliance, and continuous quality improvement. The following are the different types of documentation systems used in quality monitoring of records:

- **Check sheets**

Check sheets are standardised records used to log inspection observations and track defect frequencies during apparel production.

Defect Types/ Event Occurrence	Text Here	Text Here	Text Here	Text Here	Text Here	Text Here	Text Here
SUN							
MON							
TUE							
WED							
THU							
FRI							
SAT							

Fig. 6.2.3: Check sheet sample template

- **Flow charts**

Flow charts are graphical records used to map production and inspection sequences and provide visual guidance for standard operating procedures (SOPs). For example, the apparel quality analyst maps the process from fabric inspection and cutting to stitching, finishing, and final inspection.

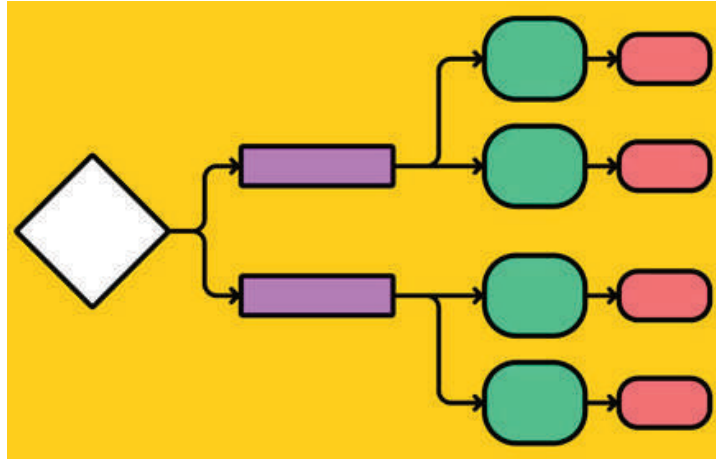


Fig. 6.2.4: Flow chart sample diagram

- **Inspection formats**

Inspection formats are standardised records used to document inspection results and ensure uniform communication of garment quality across production and quality teams. For example, the apparel quality analyst records garment measurements, defect details, inspection status, and acceptance decisions in the final inspection report.

Date	Sample #	Customer Name	Product	Dimension of sample	Review Date	Review Details

Reviewed by _____ Sign _____ Date _____

Manager Production Sign _____

Fig. 6.2.5: Inspection format sample

6.2.3 Corrective Preventive Action Planning

Corrective and preventive action (CAPA) planning is the process of identifying root causes, implementing corrective actions to eliminate existing defects, and planning preventive actions to avoid their recurrence. It helps the apparel quality analyst improve product quality, minimise recurring defects, and maintain compliance with buyer and organisational quality standards.

FMEA

Failure mode and effects analysis is a quality improvement method used to identify potential process failures, assess their impact, and prioritise risks before production. It helps the apparel quality analyst prevent defects, reduce production risks, and improve process reliability.



Failure Mode	Severity (1-lowest, 10-highest)	Occurrence (1-lowest, 10-highest)	Detection (1-lowest, 10-highest)	Risk Preference Number (RPN)
A	2	4	9	72
B	3	7	2	42
C	8	2	1	16

Fig. 6.2.6: FMEA sample diagram

The following are the stages of FMEA used in apparel quality assurance:

- **Identify failure modes**

The apparel quality analyst identifies potential failures during apparel production. For example, seam puckering, skipped stitches, incorrect fabric spreading, and shade variation are identified as failure modes.

- **Assess severity**

The apparel quality analyst assigns a severity score based on the impact of each failure on garment quality. For example, seam slippage receives a higher severity score than a loose thread.

- **Assess occurrence**

The apparel quality analyst assigns an occurrence score based on how frequently each failure is likely to occur. For example, repeated skipped stitches on a sewing line receive a higher occurrence score.

- **Assess detection**

The apparel quality analyst assigns a detection score based on the likelihood of identifying the failure before shipment. For example, hidden seam defects receive a higher detection score.

- **Prioritise actions**

The apparel quality analyst calculates the Risk Priority Number ($RPN = \text{Severity} \times \text{Occurrence} \times \text{Detection}$) to rank failures and implement corrective actions. For example, seam puckering with the highest RPN is prioritised for machine adjustment and operator retraining before bulk production.

6.2.4 Quality Control Improvement Techniques

Quality control improvement techniques are systematic methods used to improve production processes, reduce quality variations, and enhance garment quality. They help the apparel quality analyst identify improvement opportunities, optimise process performance, and achieve consistent quality standards.

Visual Control Systems

Visual control systems are quality improvement techniques that use visual indicators to monitor production status, quality performance, and process compliance in real time. They help the apparel quality analyst identify quality issues quickly, improve communication, and maintain process control. The following are the main types of visual control systems used in apparel manufacturing:

- **Physical signals**

The apparel quality analyst uses physical signals such as defect tags, sample boards, and status flags to highlight quality issues and production status. For example, a red tag is attached to garments requiring rework during in-line inspection.

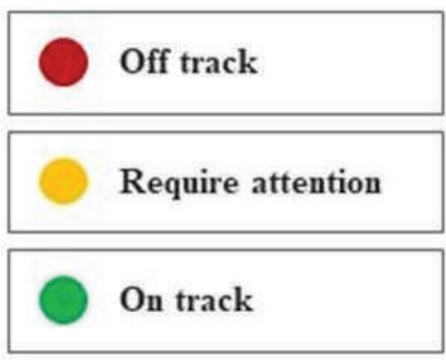
Physical signals	Images
Defect tags	
Sample board	
Status flag	

Table 6.2.1: Physical signals

- **Colour-coded floor markings**

The apparel quality analyst uses colour-coded floor markings to identify work areas, material flow, inspection zones, and non-conforming product locations. For example, red-marked areas are designated for rejected garments, while green-marked areas are used for approved garments.



Fig. 6.2.7: Colour-coded floor marking

- **Electronic tally boards**

The apparel quality analyst uses real-time electronic tally boards to display production output, defect counts, DHU, and line performance. For example, an electronic display shows hourly production targets, actual output, and defect rates for each sewing line.



Fig. 6.2.8: Electronic tally board

6.2.5 Continuous Quality Improvement Practices

Continuous quality improvement (CQI) practices are ongoing activities used to monitor, evaluate, and improve production processes and quality performance. They help the apparel quality analyst reduce recurring defects, enhance operational efficiency, and sustain continuous compliance with buyer and organisational quality standards.

5S System

The 5S System (Sort, Set in Order, Shine, Standardise, Sustain) is a workplace organisation method used to improve productivity, reduce waste, and maintain an efficient apparel production environment. It helps the apparel quality analyst organise sewing lines, improve process control, and maintain consistent quality standards.



Fig. 6.2.9: 5S- system pillars

The following are the stages of the 5S System used in apparel manufacturing:

- Sort**
 The apparel quality analyst removes unnecessary materials, tools, and defective items from the work area. For example, damaged sewing accessories and unused fabric pieces are removed from the sewing line.
- Set in order**
 The apparel quality analyst arranges tools, materials, and equipment for easy access and smooth workflow. For example, sewing threads, scissors, and measurement tapes are placed at designated workstations.
- Shine**
 The apparel quality analyst ensures machines and work areas are cleaned and inspected regularly. For example, sewing machines are cleaned daily to prevent oil stains and machine-related defects.
- Standardise**
 The apparel quality analyst establishes standard procedures to maintain workplace organisation and quality practices. For example, standard layouts and cleaning schedules are displayed at every production line.

- **Sustain**

The apparel quality analyst conducts regular audits and monitors compliance with 5S practices. For example, weekly workplace audits ensure continued adherence to 5S standards.

Kaizen

Kaizen is a continuous improvement method that encourages small, ongoing improvements to enhance productivity, quality, and process efficiency in apparel manufacturing. It helps the apparel quality analyst eliminate minor process bottlenecks, reduce defects, and promote continuous quality improvement.



Fig. 6.2.10: Kaizen pillars

The following are the stages of Kaizen used in apparel manufacturing:

- **Identify improvement opportunities**

The apparel quality analyst identifies small process inefficiencies affecting production and quality. For example, frequent thread breakage is identified as a recurring issue.

- **Analyse the cause**

The apparel quality analyst investigates the root cause using production and quality data. For example, incorrect thread tension is identified as the cause of thread breakage.

- **Implement improvements**

The apparel quality analyst introduces simple corrective measures to improve the process. For example, thread tension is adjusted and operators follow an updated sewing method.

- **Monitor results**

The apparel quality analyst reviews production performance after implementing improvements. For example, defect rates and machine stoppages decrease after the corrective actions.

- **Standardise improvements**

The apparel quality analyst incorporates successful improvements into standard operating procedures. For example, the revised sewing method is adopted across all production lines.

Summary

- Quality control (QC) ensures that apparel products meet specified quality standards throughout the manufacturing process.
- Root Cause Analysis (RCA) helps identify the underlying causes of defects to prevent their recurrence.
- Quality control tools such as Ishikawa diagrams, Pareto charts, histograms, control charts, scatter diagrams, check sheets, and flow charts support effective quality analysis and decision-making.
- Quality improvement methodologies such as DMAIC, SIPOC, FMEA, 5S, and Kaizen help improve processes and prevent defects systematically.
- Production and inspection data are analysed to identify defect patterns, process variations, and deviations from quality standards.
- Process capability indices (Cp and Cpk) measure process performance and determine whether manufacturing processes meet quality specifications.
- Check sheets, flow charts, inspection formats, and quality records provide accurate documentation for quality monitoring and traceability.
- Corrective and Preventive Action (CAPA) plans use defect analysis and quality control findings to eliminate the causes of quality issues.
- Quality control techniques help investigate root causes, prioritise defects, and improve process stability.
- Continuous quality improvement practices encourage regular monitoring, evaluation, and enhancement of production processes.
- Effective quality control documentation supports regulatory compliance, informed decision-making, and continuous process improvement.
- Applying quality control tools and improvement methodologies enhances product quality, operational efficiency, and customer satisfaction.

Exercise

Multiple-choice Question:

1. What is the primary purpose of quality control (QC) in apparel manufacturing?
 - a. To increase production cost
 - b. To ensure products meet quality standards
 - c. To reduce employee attendance
 - d. To prepare invoices
2. Which quality tool is commonly used to identify the root causes of defects?
 - a. Ishikawa diagram
 - b. Delivery schedule
 - c. Payroll register
 - d. Attendance sheet
3. What do process capability indices (Cp/Cpk) measure?
 - a. Employee productivity
 - b. Machine operating cost
 - c. Process performance against quality specifications
 - d. Warehouse capacity
4. What is the main purpose of a CAPA plan?
 - a. To increase production speed only
 - b. To eliminate the causes of defects and prevent recurrence
 - c. To prepare production schedules
 - d. To monitor employee attendance
5. Why are check sheets and quality records maintained?
 - a. To record employee salaries
 - b. To support quality monitoring, documentation, and traceability
 - c. To increase paperwork
 - d. To reduce production planning

Descriptive Questions:

1. Explain the concepts, principles, and importance of quality control (QC) in apparel manufacturing.
2. Describe the purpose of Root Cause Analysis (RCA) and quality control tools in apparel production.
3. Explain the use of production data and process capability indices (Cp/Cpk) to evaluate process performance.
4. Describe the role of quality improvement methods, CAPA plans, and quality documentation in process improvement.
5. Explain the importance of continuous quality improvement in enhancing product quality and operational efficiency.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/RfCkkcVuBfg>

Corrective preventive action planning (CAPA)





APPAREL MADE-UPS HOME FURNISHING
SECTOR SKILL COUNCIL

7. Document, Report, and Visualise Quality Data

Unit 7.1 - Documentation Reporting

Unit 7.2 - Data Analysis



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Explain the importance of systematic documentation, reporting, and data visualisation in apparel quality management.
2. Describe the standard templates, check sheets, digital tools, and reporting systems used for recording and managing production and inspection data.
3. Discuss the methods for maintaining data integrity, traceability, and compliance with organisational and industry quality standards.
4. Interpret production and quality data to identify defect patterns, process deviations, production trends, and root causes.
5. Compare different reporting methods and visualisation tools for communicating quality performance and supporting decision-making.
6. Prepare quality records, inspection reports, charts, graphs, visual dashboards, and management summaries using production and inspection data.
7. Outline the procedures for presenting quality insights, corrective actions, and performance metrics to management and cross-functional teams to support continuous improvement.
8. Highlight the role of accurate documentation, effective reporting, and visual management techniques in improving quality monitoring, operational efficiency, and informed decision-making.

UNIT 7.1: Documentation Reporting

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the importance of systematic documentation, reporting, and data visualisation in apparel quality management.
2. Describe the standard templates, check sheets, digital tools, and reporting systems used to record and manage production and inspection data.
3. Prepare quality records, inspection reports, charts, graphs, visual dashboards, and management summaries using production and inspection data.
4. Outline the procedures for presenting quality insights, corrective actions, and performance metrics to management and cross-functional teams for continuous improvement.
5. Highlight the role of accurate documentation, effective reporting, and visual management in improving quality monitoring, operational efficiency, and decision-making.

7.1.1 Quality Documentation, Reporting, and Visualisation

Quality documentation, reporting, and visualisation are essential for recording inspection results, analysing quality performance, and communicating production information accurately across apparel manufacturing. They help the apparel quality analyst maintain traceability, support informed decision-making, and ensure compliance with buyer and organisational quality standards. The following are the main components of quality documentation, reporting, and visualisation:

Component	Description	Application and example
Quality documentation	Standard records used to capture inspection results, defect details, measurements, and corrective actions throughout garment production.	The apparel quality analyst records garment measurements, defect observations, and rework details in inspection reports.
Quality reporting	Summarises quality data, production performance, and corrective actions for management review and decision-making.	The apparel quality analyst prepares a weekly report showing DHU, rejection rate, FPY, and major defect trends.
Quality visualisation	Presents production and quality data using charts, dashboards, graphs, and visual indicators for quick analysis and monitoring.	The apparel quality analyst uses a dashboard displaying defect trends, line-wise DHU, and hourly production performance to monitor quality in real time.

Table 7.1.1: Components of quality management documentation

7.1.2 Production Data Recording Systems

Production data recording systems are structured systems used to collect, record, store, and manage production and quality data throughout apparel manufacturing. They help the apparel quality analyst maintain accurate records, monitor production performance, analyse quality trends, and support data-driven decision-making. The production data recording systems are of the following types:

- **Production standard templates**

Production standards define approved specifications and quality requirements for consistent garment quality, fit, and performance. Production standard templates provide standardised formats to record inspection results, measurements, defects, and quality observations consistently.

[illegible]

Fig. 7.1.1: Production standard template

- **Check sheets**

Check sheets are structured forms used to record defect frequency, inspection observations, and quality data during production. For example, the apparel quality analyst records the number of skipped stitches, seam puckering, and oil stains on a check sheet during line inspection. They help record and maintain digital quality data by systematically capturing inspection results for analysis.

Status	Priority	Task Description	Assignee	Due Date	Notes / Comments
Complete	High	Action Item 1	Brian Gorman		
In Progress	Medium	Action item 2	Brooklyn Jansen		
Not Started	Low	Action Item 3	Carmen Robertson		
Review					
Approved					
Overdue					
On Hold					

Fig. 7.1.2: Standard check sheet sample

- Digital quality tools**

Digital quality tools are software applications used to record, store, analyse, and monitor production and quality data electronically. For example, the apparel quality analyst records inspection results and defect trends using a digital quality management system. They help record and maintain digital quality data by providing accurate, centralised, and easily accessible quality records.

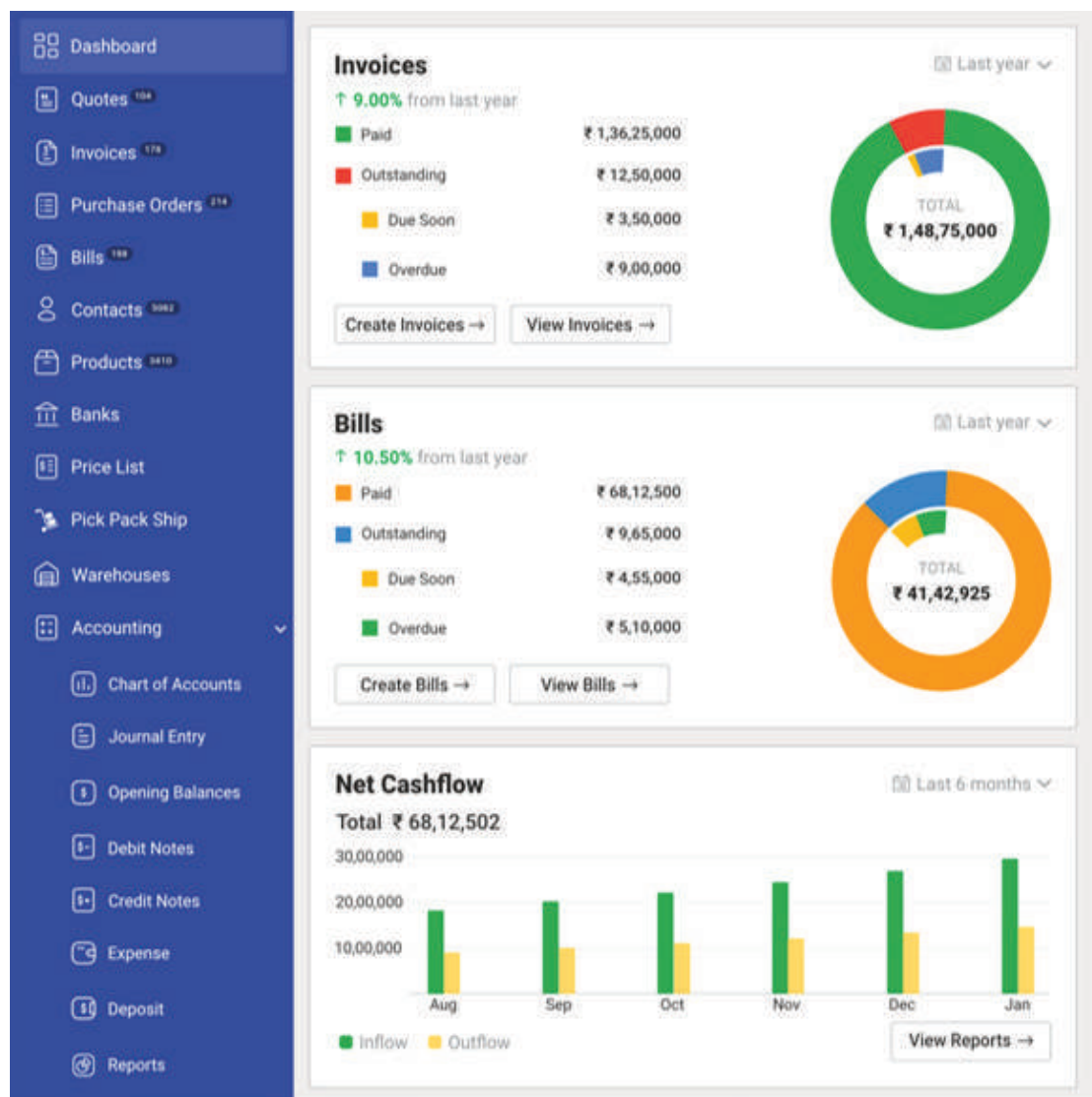


Fig. 7.1.3: Apparel offering digital dashboard template

7.1.3 Quality Records and Visual Dashboards

Quality records and visual dashboards are tools used to document inspection data and display production and quality performance through charts, graphs, and real-time dashboards. They help the apparel quality analyst monitor quality trends, track key performance indicators, and support timely, data-driven decision-making. The following are the types:

- **Digital quality dashboards**

Digital quality dashboards display real-time production and quality information such as DHU, FPY, rejection rate, and defect trends. For example, the apparel quality analyst monitors line-wise quality performance through a live dashboard during production. They help record and maintain digital quality data by automatically collecting and displaying inspection and production information.



Fig. 7.1.4: Apparel analysis parameter dashboard types and samples

- **Enterprise Resource Planning (ERP) systems**

ERP systems are integrated software platforms used to manage production, inventory, quality, and inspection records within a single system. For example, the apparel quality analyst records inspection results, non-conformities, and corrective actions in the factory ERP system. They help record and maintain digital quality data by providing a centralised database for accurate and traceable quality records.

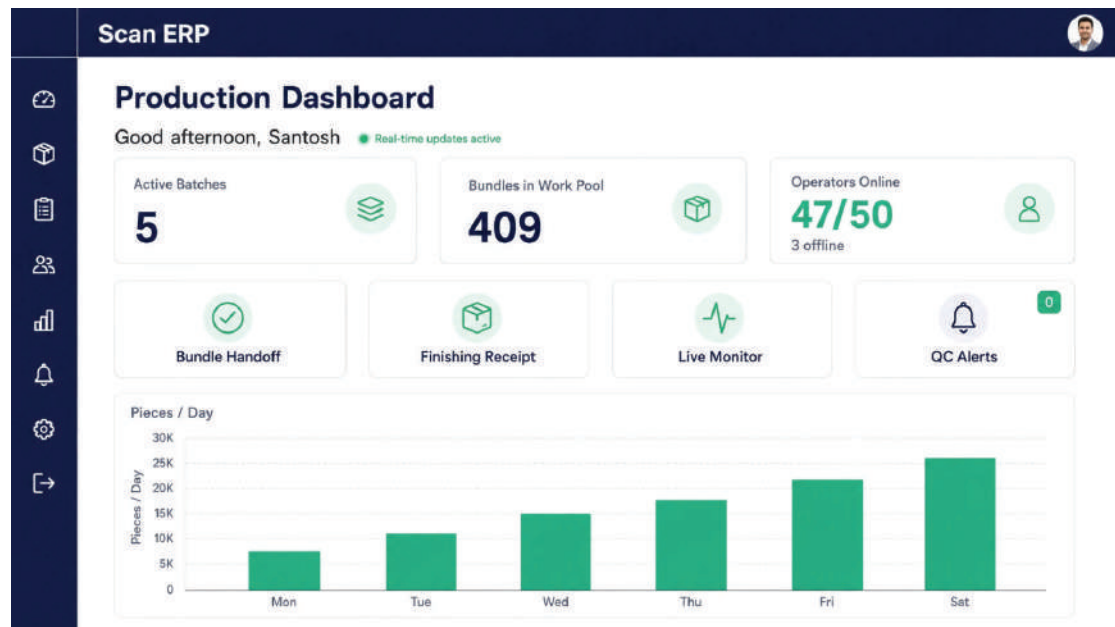


Fig. 7.1.5: ERP dashboard

- Spreadsheets**

Spreadsheets are digital worksheets used to record, organise, calculate, and analyse production and inspection data. For example, the apparel quality analyst maintains daily defect records, garment measurements, and quality KPIs in a spreadsheet. They help record and maintain digital quality data by storing structured inspection records and generating summary reports.





Fig. 7.1.6: Apparel spreadsheets bundle

7.1.4 Quality Performance Presentation Procedures

What is meant by quality performance presentation?

Quality performance presentation is the process of organising and presenting apparel quality data, inspection results, defect trends, and key performance indicators in a clear and meaningful format for review and decision-making. It helps the apparel quality analyst communicate quality performance, identify improvement opportunities, and support management in maintaining buyer and organisational quality standards.

Parameters for quality performance presentation

Parameters for quality performance presentation are the key quality indicators and production metrics used to evaluate, monitor, and present apparel quality performance for analysis and decision-making. These parameters are presented in the following ways:

Production Quality Parameter	Analysis and Presentation	Purpose
Defect Trends	Analyse defect type and frequency over time and present results using trend graphs or charts.	Identify recurring quality issues and support corrective actions.
Deviations	Compare actual quality results with specified standards and classify them as within limit, out of limit, or requiring corrective action.	Identify non-conformities and ensure quality compliance.
Production Patterns	Analyse production output and quality data over time using charts and graphs.	Identify production bottlenecks and improve operational efficiency.
Defect Patterns	Analyse recurring defect types, locations, and frequencies using Pareto charts or summary charts.	Prioritise corrective actions and reduce recurring defects.
Root Causes	Analyse inspection and process data to identify the underlying causes of quality defects and document corrective recommendations.	Eliminate recurring defects and improve product quality.

Production Quality Parameter	Analysis and Presentation	Purpose
Process Deviations	Compare process parameters with approved standards and record variations with compliance status.	Maintain process consistency and quality standards.

Table 7.1.2: Production quality analysis parameters

7.1.5 Documentation, Reporting, and Visual Management

Documentation, reporting, and visual management are systematic practices used to record, communicate, and display production and quality information throughout apparel manufacturing. They help the apparel quality analyst maintain accurate records, monitor quality performance, support informed decision-making, and ensure compliance with buyer and organisational quality standards. They are of the following types:

- **Colour-coded visual controls**

Colour-coded visual controls use coloured labels, tags, floor markings, and containers to identify work areas, material status, inspection results, and non-conforming products. For example, smart manufacturing practices promoted by the Ministry of Textiles encourage the use of colour-coded visual systems to improve workplace organisation and quality control.

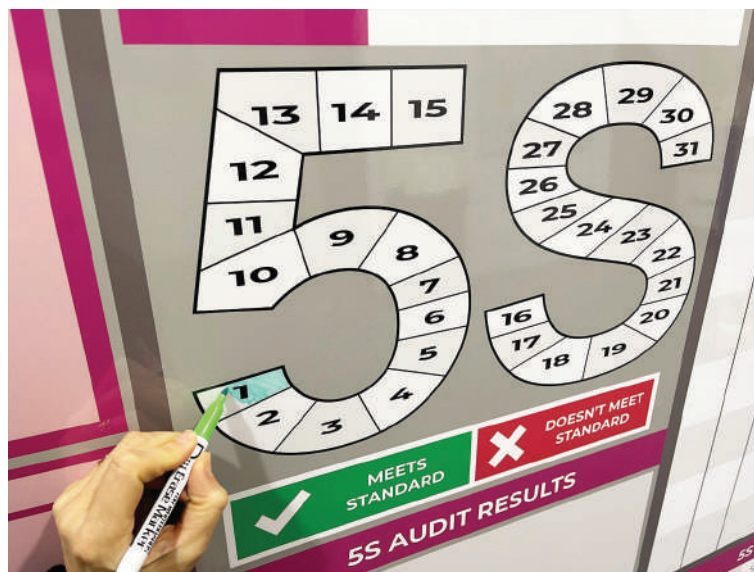


Fig. 7.1.7: colour-coded visual control system control

- **Andon and electronic status boards**

Andon and electronic status boards provide instant visual alerts on machine faults, quality issues, production stoppages, and line performance. For example, Industry 4.0 initiatives supported by the Ministry of Textiles encourage electronic monitoring systems for real-time production and quality management.



Fig. 7.1.8: Andon board

- Quality charts and graphical displays**

Quality charts and graphical displays present inspection results, Pareto charts, control charts, histograms, and trend graphs for analysing production performance and defects. For example, quality improvement projects under NM-ICPS promote the use of digital graphical tools for analysing production data and supporting quality improvement decisions.



Fig. 7.1.9: Quality tools, charts and graphical display types

UNIT 7.2: Data Analysis

Unit Objectives

By the end of this unit, the participants will be able to:

1. Discuss the methods used to maintain data integrity, traceability, and compliance with organisational and industry quality standards.
2. Interpret production and quality data to identify defect patterns, process deviations, production trends, and their root causes.
3. Compare reporting methods and data visualisation tools for communicating quality performance and supporting decision-making.

7.2.1 Data Integrity and Traceability Management

Data integrity and traceability management is the process of maintaining accurate, complete, consistent, and traceable production and quality records throughout apparel manufacturing. It helps the apparel quality analyst ensure reliable data, track garments across production stages, support compliance, and enable effective quality investigations and corrective actions. The following are the different methods of ensuring data traceability and maintaining data record integrity:

Quality and standard	Industry standard	Data traceability parameter	Data integrity best practices	Data traceability best practices
Quality Management System (QMS)	Bureau of Indian Standards IS/ISO 9001:2015	Trace quality records throughout production	Record accurate, complete, and approved data	Use document numbers, version control, and revision history
Production and Inspection Records	Organisational SOPs, Buyer Quality Standards	Trace garments by style, batch, and inspection stage	Record inspection results and defects promptly	Use garment IDs, batch numbers, and inspection dates
Equipment and Process Control	Bureau of Indian Standards IS/ISO 9001:2015	Trace equipment and production processes	Maintain accurate calibration and process records	Link equipment IDs and production batches to inspection records
Corrective Action (CAPA)	IS/ISO 9001:2015, Organisational CAPA Procedures	Trace defects to corrective actions	Record root causes and corrective actions	Link defect reports, audits, and CAPA records
Data Security and Compliance	Ministry of Electronics and Information Technology Information Technology Act, 2000	Trace record access and changes	Ensure secure storage, backups, and authorised access	Maintain audit trails, access logs, and record retention

Table 7.2.1: Data integrity and traceability standards

7.2.2 Production Quality Data Analysis

Production quality data analysis is the process of examining inspection and production data to identify defect patterns, quality trends, and areas requiring improvement. It helps organisations make informed decisions, improve product quality, and reduce production defects. The production quality data analysis is done with the following components:

- **Inspection results reports**

Inspection results reports summarise the quality status of garments by recording accepted, rejected, and defective items identified during inspections. For example, the apparel quality analyst prepares a final inspection report showing defect counts, defect types, and acceptance rates for a production batch. They help analyse production quality by identifying overall quality performance and recurring defects.

Format No.		
Material ID	Material Name	End User Department
Purchase Order No. & Date	Supplier Name	
Material Description		
Nos. of Sample Taken	Initial Sample Test Plan	
Nos. of Trial		
External Standards Used		Internal Standards
Material Specifications		
Material Standards		
Acceptable Tolerance / Criteria		
Method Used		
Tests	Acceptable Limits	Result
Remarks		
Inspector Name & Signature:	Date:	Purchase Manager Signature:

Fig. 7.2.1: Inspection report sample template

- **Trend reports**

Trend reports analyse quality data over a period to identify recurring defects, production patterns, and process variations. For example, the apparel quality analyst prepares a monthly defect trend report to monitor increases in seam defects or shade variations. They help analyse production quality by identifying trends that require process improvements.

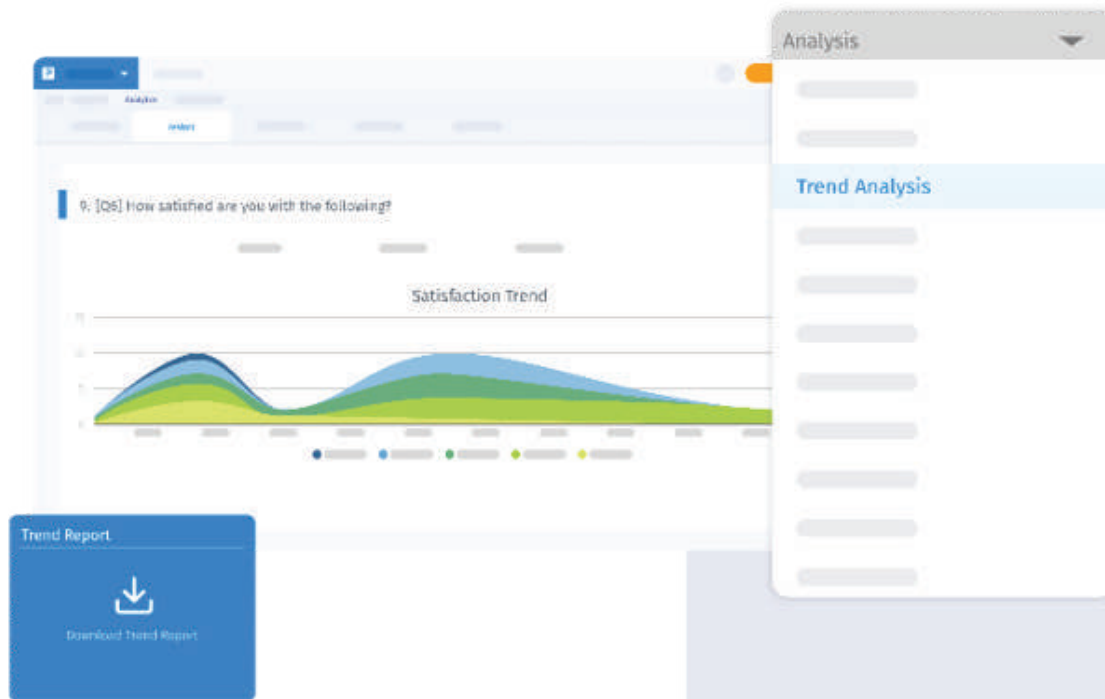


Fig. 7.2.2: Trend report sample template

- **Corrective action reports**

Corrective action reports document the root causes of quality issues, corrective measures implemented, and their effectiveness. For example, the apparel quality analyst records actions taken to reduce skipped stitches after identifying repeated sewing defects. They help analyse production quality by tracking improvements and preventing defect recurrence.

Date and Time of Incident / Exposure		Location	
EMPLOYEES INVOLVED			
DETAILED INCIDENT / EXPOSURE DESCRIPTION			

ULTIMATE CAUSE OF INCIDENT/EXPOSURE (I.E. "WHO, WHAT, WHEN, WHERE, HOW" AND THE "5 WAYS" ... THE ROOT CAUSE)
OPTIONS FOR ELIMINATION OR CONTROL OF THE ROOT CAUSE(S)
CORRECTIVE ACTIONS TAKEN / DATE / NAME OF PERSON(S) MAKING CORRECTIONS

Witnesses: _____

Investigated by: _____ Date: _____

Fig. 7.2.3: Corrective action report sample template

- **Management review reports**

Management review reports consolidate inspection findings, quality trends, key performance indicators, and corrective actions for decision-making. For example, the apparel quality analyst presents a monthly quality summary report to production and quality managers during review meetings. They help analyse production quality by supporting performance evaluation and continuous improvement planning.

Unit / Location	
Project#	
Document name	
Document#	
Displine checker	
Item/part (if Specified..).#	
Drawing#	
Details	
Document rev.#	
Interdiscipline checker	

#	Page	Chapter	Comments

Fig. 7.2.4: Management review report sample template

7.2.3 Quality Reporting Visualisation Tools

Quality reporting visualisation tools present quality data using charts, graphs, dashboards, and reports for easy interpretation. These tools help monitor quality performance, identify trends, and support timely decision-making. The following are the different types of visual tools and techniques to ensure quality reporting for an apparel quality analyst:

- **Bar charts**

Bar charts compare defect counts, rejection rates, and inspection results across production lines, garment styles, or batches. They are used to communicate inspection results reports to the Quality Team, Production Team, Final Inspection Team, and Management Team, helping them compare quality performance and identify areas requiring immediate attention.



Fig. 7.2.5: Bar chart

- **Line graphs**

Line graphs show changes in defect rates, rejection percentages, and quality performance over a period. They are used to communicate trend reports to the Management Team, Planning Team, Production Team, Merchandising Team, and Quality Team, helping them monitor quality trends, production consistency, and process improvements.

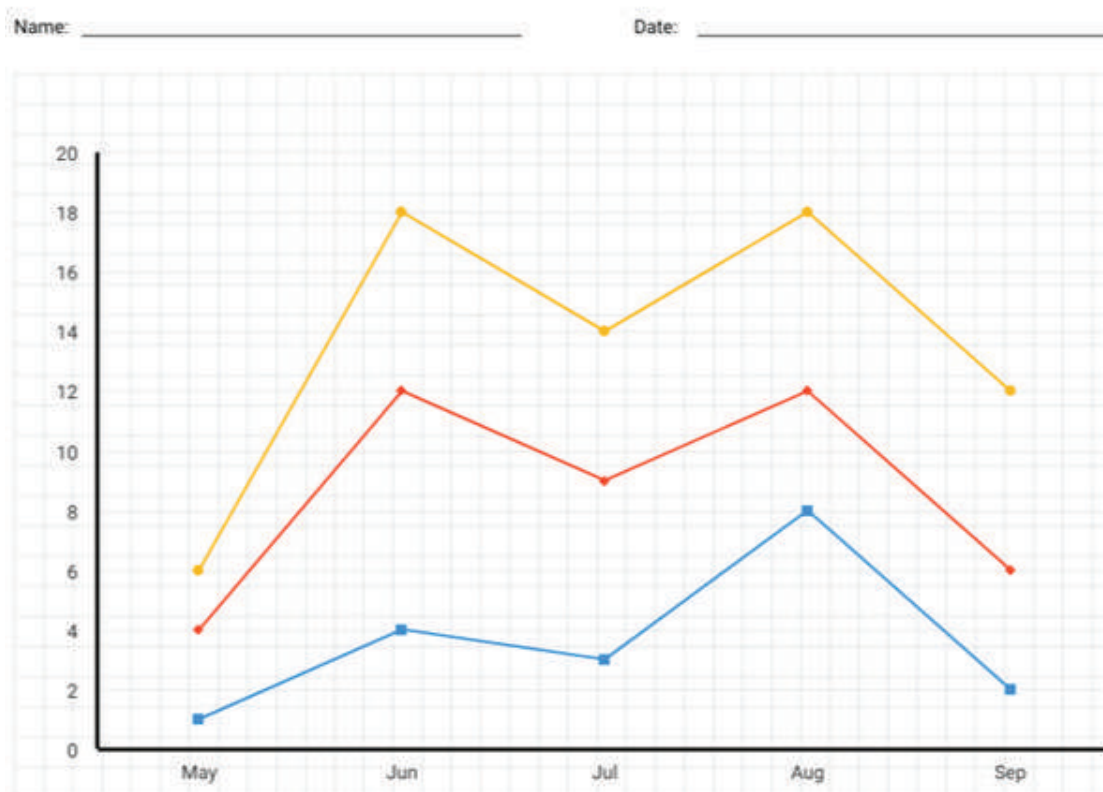


Fig. 7.2.6: Line graph sample template

- Pie charts**

Pie charts display the proportion of different defect types, root causes, or corrective actions taken during production. They are used to communicate corrective action reports to the Quality Team, Production Team, Material Team, and Management Team, helping them understand the major contributors to quality issues and prioritise improvement efforts.

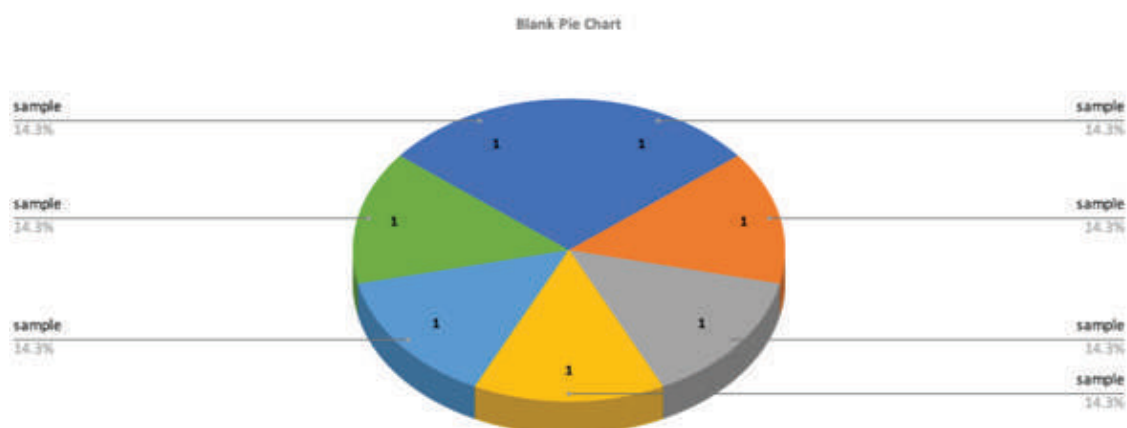


Fig. 7.2.7: Pie-chart sample template

- **Summary tables**

Summary tables organise key quality indicators, inspection outcomes, defect trends, corrective actions, and production performance into a structured format for easy review. They are used to communicate management review reports to the Management Team, Merchandising Team, Planning Team, Material Team, Quality Team, Production Team, Final Inspection Team, and Shipment Team, helping all departments review quality performance, monitor progress, and support informed decision-making.

	CONCEPT A	CONCEPT B	CONCEPT C	CONCEPT D
DESCRIPTION				
ADVANTAGES				
DISADVANTAGES				
Summary:				

Fig. 7.2.8: Summary table sample template

Summary

- Systematic documentation and reporting help maintain accurate quality records throughout apparel production.
- Standard templates, check sheets, and digital tools ensure consistent recording of production and inspection data.
- Quality records, inspection reports, charts, graphs, and dashboards provide clear information for quality monitoring.
- Data visualisation helps present quality information in an easy-to-understand format for faster decision-making.
- Data integrity and traceability ensure that production records are accurate, complete, and easily retrievable.
- Maintaining proper documentation supports compliance with organisational and industry quality standards.
- Production and quality data are analysed to identify defect patterns, process deviations, production trends, and root causes.
- Different reporting methods and visualisation tools help communicate quality performance effectively to stakeholders.
- Quality insights, corrective actions, and performance metrics support management review and continuous improvement.
- Accurate documentation improves transparency, accountability, and operational efficiency.
- Effective reporting and visual management help monitor production performance and support informed decision-making.
- Proper documentation, reporting, and data analysis improve product quality, process control, and customer satisfaction.

Exercise

Multiple-choice Question:

1. Why is systematic documentation important in apparel quality management?
 - a. To increase paperwork
 - b. To maintain accurate quality records
 - c. To reduce production time only
 - d. To calculate employee salaries

2. Which document is commonly used to record production and inspection data?
 - a. Check sheet
 - b. Attendance register
 - c. Salary slip
 - d. Purchase order

3. What is the main purpose of data visualisation in quality management?
 - a. To increase production costs
 - b. To present quality information for better decision-making
 - c. To replace quality inspections
 - d. To prepare payroll reports

4. Why is data integrity important in quality management?
 - a. To ensure accurate, reliable, and traceable records
 - b. To reduce employee training
 - c. To increase inventory levels
 - d. To improve product packaging

5. What is the purpose of presenting quality reports and dashboards to management?
 - a. To monitor attendance
 - b. To support quality decisions and continuous improvement
 - c. To prepare marketing plans
 - d. To schedule employee leave

Descriptive Questions:

1. Explain the importance of systematic documentation and reporting in apparel quality management.
2. Describe the role of standard templates, check sheets, digital tools, and reporting systems in managing production and inspection data.
3. Explain the importance of data integrity, traceability, and compliance in quality management.
4. Describe how production and quality data are analysed and presented using reports, charts, and visual dashboards.
5. Explain how accurate documentation, reporting, and visual management support quality monitoring, operational efficiency, and continuous improvement.

Notes

This image shows a full page of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for handwriting practice or general writing. There are no margins, text, or other markings on the page.

Scan the QR codes or click on the link to watch the related videos



https://youtu.be/Fp22WTke_iE

Production data recording systems (Excel)

8. Promote and Sustain Safety, Health, and Security in Workplace, while Fostering Gender and Persons with Disabilities (PwD) Sensitisation



Unit 8.1 - Workplace Safety and Compliance

Unit 8.2 - Equipment Operations and Documentation

Unit 8.3 - Quality Environment and Sustainability



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Describe safe working practices for the operation, cleaning, maintenance, and storage of tools, equipment, and machinery in the apparel workplace.
2. Explain workplace health, safety, environmental, and organisational procedures related to quality operations and equipment handling.
3. Discuss the effects of contamination, such as machine oil, dirt, and improper handling, on garment quality and production.
4. Identify workplace hazards, risks, accidents, and emergency situations, and explain the appropriate response, evacuation, and reporting procedures.
5. Outline the procedures for obtaining work instructions, interpreting job cards, clarifying task requirements, and meeting assigned work targets.
6. Describe the methods for inspecting tools, equipment, work areas, and finished products to ensure safety, operational readiness, and compliance with quality standards.
7. Prepare workplace records, forms, and reports related to equipment status, safety observations, defects, and production activities.
8. Compare different methods of waste reduction, material reuse, and safe disposal of waste and by-products to promote sustainable manufacturing practices.
9. Highlight the importance of maintaining good health, personal hygiene, and safe work habits while avoiding alcohol, tobacco, and other intoxicants in the workplace.
10. Explain the procedures for reporting defective tools, machine malfunctions, workplace hazards, and quality issues to the appropriate personnel.
11. Discuss the importance of following organisational quality standards, legal requirements, and standard operating procedures to ensure safe and efficient production.
12. Elaborate on the role of workplace safety, environmental responsibility, proper documentation, and continuous housekeeping in improving productivity, product quality, and employee well-being.

UNIT 8.1: Workplace Safety and Compliance

Unit Objectives

By the end of this unit, the participants will be able to:

1. Describe safe work practices for operating, cleaning, maintaining, and storing tools, equipment, and machinery in the apparel workplace.
2. Explain workplace health, safety, environmental, and organisational procedures for quality operations and equipment handling.
3. Elaborate on workplace hazards, risks, accidents, and emergencies, and explain the appropriate response, evacuation, and reporting procedures.
4. Highlight the importance of good health, personal hygiene, and safe work habits while avoiding alcohol, tobacco, and other intoxicants at work.
5. Discuss the importance of following organisational quality standards, legal requirements, and standard operating procedures for safe and efficient production.

8.1.1 Safe Equipment Operation and Maintenance

Safe equipment operation and maintenance involves operating, inspecting, and maintaining equipment according to approved safety procedures and manufacturer guidelines. It helps prevent accidents, ensures reliable equipment performance, and maintains a safe workplace. The apparel quality analyst can make use of the equipment safety inspection checklist to safeguard equipment usage:

OPERATOR: _____ SHIFT: _____
DATE: _____

CHECKLIST	MON	TUES	WED	THURS	FRI	SAT	SUN
Operating & Emergency Controls							
Safety Devices							
Personal Protective Devices							
Tires & Wheels							
Outriggers (if applicable) & other Structures							
Air/Hydraulics & Fuel System for Leaks							
Cables & Wiring Harnesses							
Picard/Warning Control Markings							
Operating Manuals							
Guardrail System							
Engine Oil Level (if applicable)							
Battery Fluid Level							
Hydraulic Reservoir Level							
Coolant Level (if applicable)							
Loose or Missing parts							
Braking Device(s) Operating Properly							
Motion Alarms							

WARNING: Do not operate equipment without proper authorization and training.
Additional Comments: _____

SUPERVISOR: _____

Fig. 8.1.1: Equipment safety inspection checklist

The Occupational Safety, Health and Working Conditions (OSH) Code, 2020 mandates the safe operation, inspection, maintenance, and storage of machinery, tools, and equipment to ensure workplace safety in factories, including apparel manufacturing.

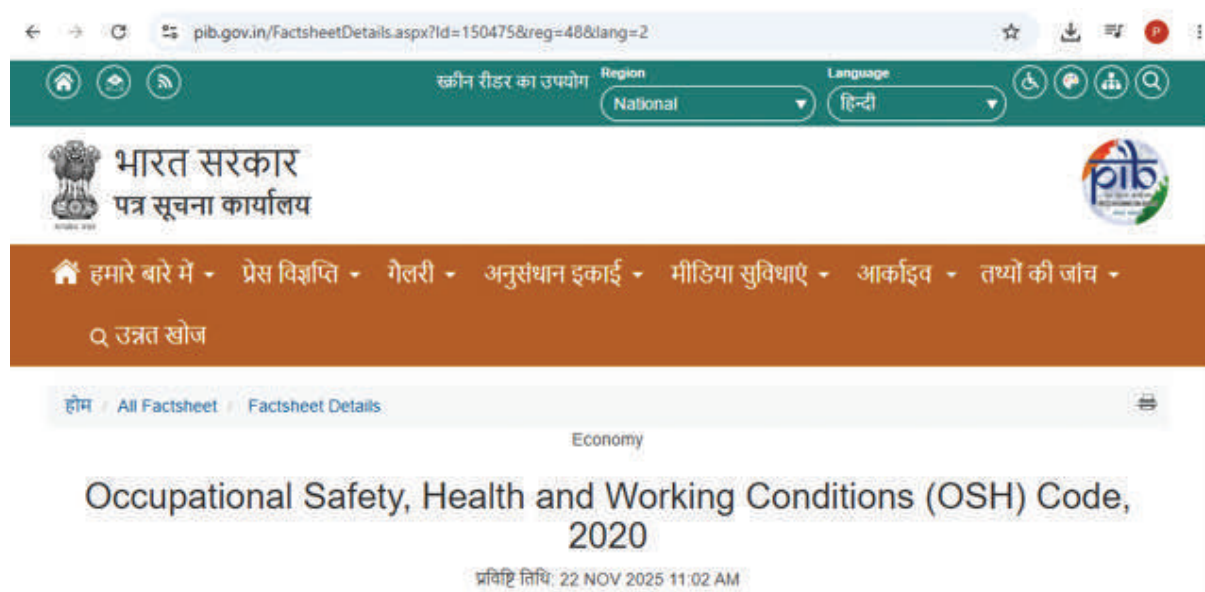


Fig. 8.1.2: OSCH 2020 dashboard

The following are the stages of safe equipment operation and maintenance:

- **Equipment safety inspection**

Equipment and tools used in apparel manufacturing are inspected before use to ensure they are safe, functional, and free from damage. Unsafe or defective equipment is identified and removed from service before production.

- **Tool selection and use**

The correct apparel tools and equipment are selected according to the production process, manufacturer's instructions, and organisational procedures. Proper use of tools ensures safe operation, accurate garment production, and prevents equipment damage.

- **Equipment handling practices**

Apparel tools and equipment are handled carefully during cutting, stitching, finishing, and inspection to minimise wear, prevent accidents, and maintain operational safety. Safe handling also improves equipment performance and extends service life.

- **Storage and maintenance**

Apparel materials, tools, and equipment are cleaned, stored, and maintained according to manufacturer and organisational requirements after use. Proper storage protects equipment from damage, ensures readiness for future use, and supports workplace safety. The following are the methodologies of storing and maintaining equipment used in apparel industry:

Equipment	Storage procedure
Cutting machine	Clean the machine, cover the cutting blade, switch off the power supply, and store it in accordance with the manufacturers and organisational safety requirements.
Sewing machine	Remove lint, clean the machine, cover it to prevent dust accumulation, switch off the power supply, and store it according to manufacturer instructions.

Equipment	Storage procedure
Overlock machine	Clean the thread path and knife area, remove fabric waste, cover the machine, and store it in a clean, dry location as per organisational procedures.
Flatlock machine	Clean the machine, remove thread and fabric residues, cover it properly, and store it following manufacturer recommendations.
Button attaching machine	Clean the machine, remove loose buttons and thread, switch off the power supply, and store it in a designated equipment area.
Buttonhole machine	Clean the cutting knife and stitch area, cover the machine, and store it safely according to manufacturer and organisational requirements.
Zipper attaching machine	Remove thread and fabric residues, clean the machine, switch off the power supply, and store it in a dry, designated location.
Pressing and finishing machine	Allow the equipment to cool completely, switch off the steam and electrical supply, clean the surface, and store it according to safety procedures.
Inspection machine	Clean the inspection table, rollers, and lighting unit, switch off the electrical supply, cover the machine, and store it in a dust-free environment.

Table 8.1.1: Apparel equipment storage procedures

- **Accessible equipment adaptation**

Equipment, tools, and workstations are adapted with appropriate accessibility features and reasonable accommodation to enable safe operation by persons with disabilities. These adaptations are provided in accordance with the Rights of Persons with Disabilities (RPwD) Act, 2016 to ensure equal access, workplace safety, and inclusive participation in apparel manufacturing.

8.1.2 Workplace Health Safety Procedures

Workplace health safety procedures are approved practices that protect employees from workplace hazards, injuries, and occupational health risks while ensuring regulatory compliance and a safe working environment. The apparel quality analyst uses the workplace health and safety checklist to implement these procedures in accordance with the Occupational Safety, Health and Working Conditions (OSH) Code, 2020.

Location: [Specify location]

Date: [Insert date]

Inspector(s): [Insert name(s)]

Department/Area Inspected: [Specify area]

Item	Description	Yes/No/NA	Notes/Action Required	Completed By	Completion Date
1.1	All employees have completed mandatory safety training				
1.2	Risk assessments have been conducted for all work areas				
1.3	PPE is provided, maintained, and used correctly by employees				
1.4	Emergency response plans				

Fig. 8.1.3: Workplace health and safety inspection checklist

The following are the stages of workplace health safety procedures:

- **Hazard identification and assessment**

Workplace hazards such as unsafe machinery, electrical risks, poor lighting, excessive noise, and ergonomic issues are identified and assessed before work begins. Identified hazards are reported and controlled to minimise the risk of accidents and occupational injuries.

- **Personal protective equipment**

Appropriate personal protective equipment (PPE) such as safety gloves, masks, aprons, eye protection, and safety shoes is selected and used according to the task and organisational procedures. Proper use of PPE protects workers from workplace hazards and reduces the risk of injury.

- **Safe workplace practices**

Safe work practices are followed during cutting, stitching, finishing, material handling, and inspection to prevent accidents and maintain operational safety. Good housekeeping, safe equipment handling, and compliance with safety procedures ensure a healthy working environment.

- **Emergency response procedures**

Emergency procedures for fire, electrical hazards, injuries, and evacuation are followed according to organisational emergency plans. Prompt reporting, first aid, and safe evacuation help minimise injuries and protect employees during workplace emergencies.

- **Accessible workplace safety measures**

Workplace safety procedures, emergency facilities, evacuation routes, and personal protective equipment are adapted to meet the accessibility needs of persons with disabilities. These measures are implemented in accordance with the Rights of Persons with Disabilities (RPwD) Act, 2016 to ensure safe, accessible, and inclusive working conditions.

8.1.3 Workplace Hazard Emergency Management

What is a workplace hazard?

A workplace hazard is any condition, equipment, material, or work practice that can cause injury, illness, property damage, or disruption during apparel manufacturing. Identifying and controlling workplace hazards helps ensure employee safety, regulatory compliance, and a safe working environment.

Potential hazards in workplace

The following are some common potential hazards in workplace:

- **Physical hazards**

Physical hazards include moving machinery, sharp tools, slippery floors, excessive noise, poor lighting, and hot surfaces that may cause injuries or accidents.



Fig. 8.1.3: Physical hazards types

- **Mechanical hazards**

Mechanical hazards arise from sewing machines, cutting machines, presses, and other equipment with moving parts that may cause cuts, entanglement, or crushing injuries.

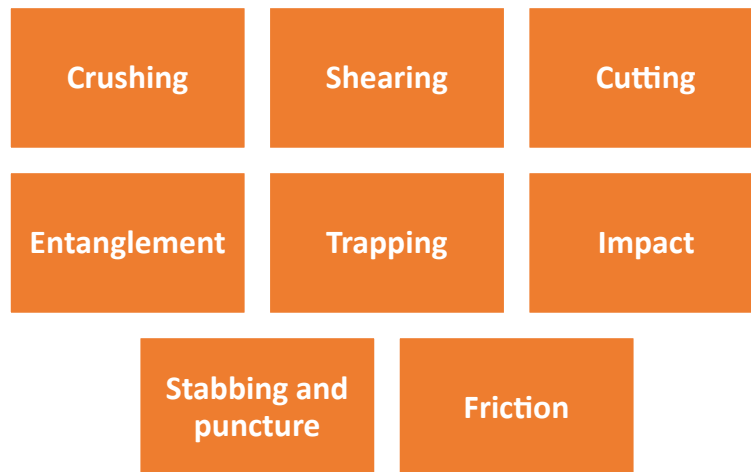


Fig. 8.1.4: Mechanical hazard types

- **Electrical hazards**

Electrical hazards result from exposed wiring, faulty equipment, overloaded circuits, or damaged electrical connections that may cause electric shock or fire.



Fig. 8.1.5: Electrical hazard types

- **Chemical hazards**

Chemical hazards involve exposure to dyes, solvents, adhesives, cleaning agents, and finishing chemicals that may affect health or damage the environment if handled improperly.



Fig. 8.1.6: Chemical hazard identifiers

- Ergonomic hazards**

Ergonomic hazards arise from repetitive movements, prolonged standing, poor posture, and improper workstation design, leading to fatigue and musculoskeletal disorders.

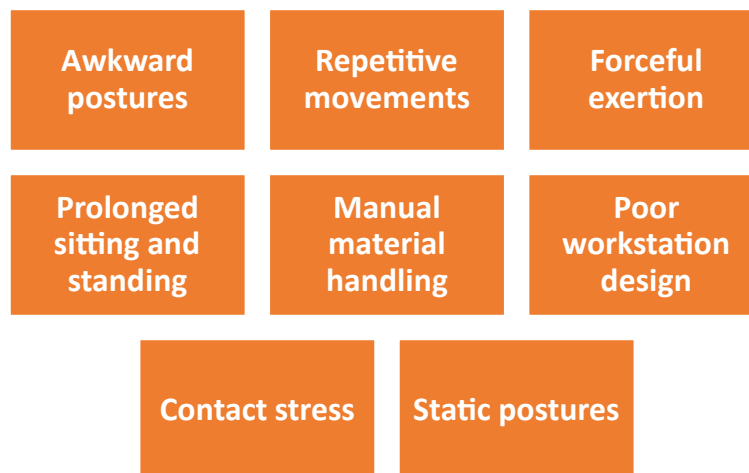


Fig. 8.1.7: Ergonomic hazard types

- Fire hazards**

Fire hazards include flammable fabrics, chemicals, electrical faults, and heat-generating equipment that may lead to fires or explosions.



Fig. 8.1.8: Fire hazard types

- **Biological hazards**

Biological hazards include mould, bacteria, fungi, and poor hygiene conditions that may affect employee health and product quality.



Fig. 8.1.9: Biological hazard types

- **Environmental hazards**

Environmental hazards include improper waste disposal, chemical spills, excessive dust, poor ventilation, and pollution that may impact the workplace and surrounding environment.



Fig. 8.1.10: Environmental hazard types

What is a workplace threat?

Workplace threat is any situation, act, or condition that may endanger the safety, security, health, or normal operations of employees and the workplace in the apparel industry. Identifying and responding to workplace threats helps prevent harm, protect assets, and ensure business continuity.



Fig. 8.1.11: Workplace threat control stages

The following are the main types of workplace threats:

- **Safety threats**

Safety threats include fire, electrical, mechanical, equipment, and workplace hazards that may cause accidents, injuries, or property damage. They are controlled through safe work practices, equipment maintenance, and emergency preparedness.

- **Health threats**

Health threats include chemical exposure, dust, excessive noise, poor ergonomics, biological hazards, and unhealthy work practices that may affect employee well-being. They are controlled through PPE, hygiene practices, ventilation, and occupational health measures.

- **Security threats**

Security threats include theft, unauthorised access, vandalism, sabotage, workplace violence, and other incidents that affect employee safety and organisational assets. They are managed through access control, surveillance, reporting procedures, and emergency response.

- **Environmental threats**

Environmental threats include chemical spills, pollution, improper waste disposal, resource wastage, and natural disasters that affect the workplace and surrounding environment. They are controlled through environmental management practices, waste management, pollution prevention, and disaster preparedness.

What are workplace emergencies?

Workplace emergencies are unexpected events or incidents that threaten the safety, health, security, or normal operations of employees and the workplace in the apparel industry. Responding promptly and following established emergency procedures helps minimise injuries, protect property, and ensure

business continuity. The workplace emergency management cycle involves preventing, preparing for, responding to, and recovering from workplace emergencies to protect employees, minimise damage, and restore normal operations.



Fig. 8.1.12: Emergency management cycle

The following are the main types of workplace emergencies:

- **Fire emergencies**

Fire emergencies include fires, explosions, smoke incidents, and overheating of equipment that may endanger employees and damage property. They are managed through fire detection systems, emergency evacuation, firefighting equipment, and emergency response procedures.

- **Medical emergencies**

Medical emergencies include injuries, sudden illness, chemical exposure, burns, and other health-related incidents requiring immediate assistance. They are managed through first aid, emergency medical services, incident reporting, and prompt medical treatment.

- **Equipment and utility emergencies**

Equipment and utility emergencies include machine breakdowns, electrical failures, gas leaks, power outages, and other operational failures that disrupt production or create safety risks. They are managed through emergency shutdown procedures, equipment isolation, maintenance support, and timely reporting.

- **Natural and security emergencies**

Natural and security emergencies include floods, earthquakes, storms, unauthorised access, workplace violence, and other incidents affecting employee safety and workplace security. They are managed through evacuation procedures, emergency communication, access control, and disaster preparedness plans.

Potential hazards, threats, and emergencies in apparel industry

The following are the main types of potential hazards, threats, and emergencies in the apparel industry:

- **Cuts and lacerations**

Cuts and lacerations occur due to sharp cutting machines, scissors, knives, needles, or broken tools used during garment production. They are prevented through safe tool handling, machine guards, and the use of appropriate personal protective equipment.



Fig. 8.1.13: Cuts and laceration

- **Burns and scalds**

Burns and scalds result from pressing equipment, steam irons, hot machine surfaces, electrical faults, or chemical exposure. They are prevented through safe equipment operation, temperature control, PPE, and emergency response procedures.

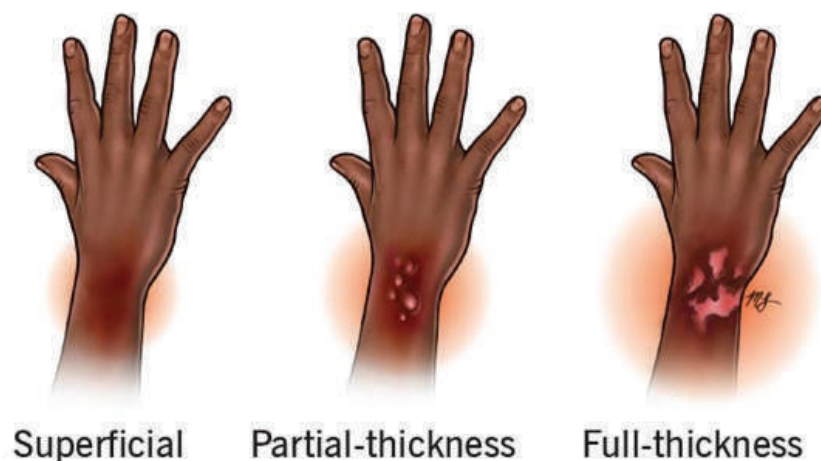


Fig. 8.1.14: Burns and scalds

- **Musculoskeletal injuries**

Musculoskeletal injuries occur due to repetitive work, improper lifting, poor posture, or awkward workstation design. They are prevented through ergonomic workstations, safe material handling, stretching exercises, and correct working techniques.

Musculoskeletal injuries	Images
Strains	
Sprains	
Lower back injuries	
Neck and shoulder injuries	

Musculoskeletal injuries	Images
Knee injuries	

Table 8.1.2: Common workplace musculoskeletal injuries

- Electric shock and fire injuries**

Electric shock and fire injuries occur due to faulty electrical equipment, exposed wiring, overloaded circuits, or workplace fires. They are prevented through regular electrical inspections, equipment maintenance, emergency preparedness, and compliance with workplace safety procedures.

Common electrical shock and fire injuries	Images
Electric shock	
Electric burns	

Common electrical shock and fire injuries	Images
Thermal burns	
Smoke inhalation	
Fire-related eye injuries	

Table 8.1.3: Common electrical shock and fire injuries

What is hazard emergency management?

Workplace hazard emergency management involves identifying workplace hazards, managing emergencies, and following environmental management procedures to protect employees, property, and the environment. The apparel quality analyst uses the workplace hazard and emergency management checklist in accordance with the Occupational Safety, Health and Working Conditions (OSH) Code, 2020 and organisational environmental management requirements.

Location/venue: _____

Owner/User: _____

Date: ____ / ____ / 20____

Potential Hazard	Visually/ Physically Checked ✓	Findings	Hazards identified and action planned	Action Taken
Fire safety hazards (eg fuel storage, papers, heaters)				
Fire equipment in working order (eg fire extinguisher) and easily accessible				
Emergency evacuation (clear path, assembly area)				
Electrical hazards				
Injury hazards (eg floor surfaces, boxes inappropriately stores)				
Personal protection equipment in working order (eg. eye glasses)				
Chemicals and harmful substances stored appropriately, labeled, MSDS displayed etc				
Site safety check				
Other pre-course checks				

Fig. 8.1.15: Hazard and emergency management checklist

The following are the stages of workplace hazard emergency management:

- **Hazard identification and reporting**

Workplace hazards such as fire risks, chemical spills, electrical faults, blocked exits, and unsafe conditions are identified and reported promptly. Timely reporting helps prevent accidents and supports effective risk control.

- **Emergency response and evacuation**

Emergency procedures for fire, chemical exposure, equipment failure, and workplace accidents are followed according to organisational emergency plans. Safe evacuation and prompt emergency response minimise injuries and protect personnel.

- **Environmental management practices**

Environmental management procedures such as waste segregation, spill control, pollution prevention, and resource conservation are followed during apparel manufacturing. These practices minimise environmental impact and ensure compliance with organisational environmental requirements.

- **Incident reporting and corrective actions**

Workplace incidents, hazards, and environmental emergencies are documented, investigated, and reported according to organisational procedures. Corrective actions are implemented to prevent recurrence and improve workplace safety and environmental performance.

- **Accessible emergency preparedness**

Emergency communication, evacuation procedures, assembly points, and assistance arrangements are made accessible for persons with disabilities during workplace emergencies. These measures are implemented in accordance with the Rights of Persons with Disabilities (RPwD) Act, 2016 to ensure safe, inclusive, and effective emergency management.

Emergency evacuation

Emergency evacuation is the organised and safe movement of employees from the workplace to designated assembly points during emergencies such as fire, chemical spills, or natural disasters. It helps protect lives, minimise injuries, and ensure a timely response in accordance with organisational emergency procedures.

LOCATION/AREA:		DATE:/..... 20	
EMERGENCY WARDEN NAME:			
NATURE OF EMERGENCY: ☒			
FIRE	☐	CHEMICAL SPILL	☐
GAS EMISSION/LEAK	☐	EXPLOSION	☐
ARMED HOLD UP	☐	BOMB THREAT	☐
OTHER:	☐ (Give Details)		
RECORD OF TIMES / ACTIVITIES:			
ALARM SOUNDED/HEARD	☐	Time:	
EMERGENCY WARDEN RESPONDED	☐	Time:	
EVACUATION COMMENCED	☐	Time:	
AREA CHECKED	☐	Time:	
EVACUATION COMPLETED	☐	Time:	
ROLL CALL CONDUCTED	☐	Time:	
EVACUATION REPORT TO CHIEF WARDEN	☐	Time:	
ADVICE OF EMERGENCY BEING OVER	☐	Time:	
RETURN TO WORK AREA	☐	Time:	
EMERGENCY SERVICES:			
POLICE	Notified	☐	Attended ☐
FIRE BRIGADE	Notified	☐	Attended ☐
AMBULANCE	Notified	☐	Attended ☐
OTHER SERVICES NOTIFIED:			
DEPT ENVIRONMENTAL CONTROL	Notified	☐	Attended ☐
WESTERN POWER	Notified	☐	Attended ☐
WATER AUTHORITY	Notified	☐	Attended ☐
OTHER (.....)	Notified	☐	Attended ☐
COMMENTS / OBSERVATIONS / OTHER ACTIVITIES (COMPLETE OVER PAGE IF NECESSARY):			

Fig. 8.1.16: Emergency evacuation checklist

The following are the stages of emergency evacuation:

- **Evacuation planning and communication**

An emergency evacuation plan, evacuation map, escape routes, emergency exits, and assembly points are prepared and communicated before emergencies occur. Emergency situations are identified promptly, alarms are activated, and employees receive clear evacuation instructions through approved communication systems.



Fig. 8.1.17: Emergency evacuation map

- **Safe and accessible evacuation**

Employees stop work, safely shut down equipment where applicable, and evacuate through designated emergency exits.



Fig. 8.1.18: Emergency assembly point

Persons with disabilities are provided accessible routes, visual and audible alarms, evacuation assistance, and reasonable accommodation in accordance with the Rights of Persons with Disabilities (RPwD) Act, 2016.



Fig. 8.1.19: Emergency evacuation spot relevant for PwD

- Assembly and emergency response**

Employees assemble at the designated assembly point, where headcounts are conducted and missing persons are reported. First aid is provided, and emergency services respond according to organisational emergency procedures.

EMERGENCY & DISASTER PREPAREDNESS LIST

FEMA RECOMMENDED			
Batteries - for Radios; Cell Phones; Flashlights		Moist Towelettes	
Battery Powered or Hand Crank Radio for Alerts		Non-perishable food for several days	
Can Opener		Water - One gallon per person, per day for several days	
Cell Phone Charger & Extra Battery		Whistle to use to signal for help	
Dust Mask, Duck Tape & Plastic Sheetting to Section off Contaminated Areas		Wrench or Pliers to turn off utilities	
First Aid Kit - Bandages, Alcohol, Eye Wash, Tweezers, Antibacterial Cream, etc.			
Garbage Bags & Plastic Ties			
Local Map			
ADDITIONAL ITEMS TO CONSIDER			
Allergy Medication	Family Documents	Matches/Lighter	Shoes - All Weather
Antacids	Feminine Products	Mess Kit	Shovel
Anti-diarrheal Meds	Fire Extinguisher	Pain Relievers	Sleeping Bags
Antibacterial Wipes	First Aid Book	Paper Towels	Socks - Waterproof
Backpack - Waterproof	Flashlights	Paper, Pens & Pencils	Tent
Bank Account Info	Gas in Safety Can	Paper/Plastic Cups	Toothpaste
Blankets	Glasses/Contacts	Paper/Plastic Plates	Toothbrushes
Books, Games & Toys	Gloves	Passwords	Towels - Bath
Cash - Bills & Coins	Hand Sanitizer	Pet Food, Bowl & Leash	Towels - Kitchen
Clothes - Extra Set	Handsaw	Pillows	Vehicle Registration
Coat - All Weather	Infant Formula	Plastic Tarp	Washcloths
Contact Lens Solution	Insurance Policies	Pots & Pans	Water Canteen

☐ Diaper Rash Cream	☐ Knife	☐ Portable Burner	☐
☐ Diapers	☐ Laptop/iPad	☐ Prescription Meds	☐
☐ Disposable Utensils	☐ Laxatives	☐ Sewing Kit	☐
☐ Driver's License	☐ Life Preserver/Jackets	☐ Soap	☐

To assemble your kit, store items in airtight plastic bags and put your entire disaster supplies kit in one or two easy to carry containers such as plastic bins or a duffel bag.

Fig. 8.1.20: Emergency preparedness checklist

- Incident reporting and recovery**

The emergency is documented, investigated, and corrective actions are implemented before work resumes. Employees re-enter the workplace only after official clearance from authorised personnel.

Incident Report Form	
Reported by	Location
Incident Time	Time Reported
Person Involved: Staff ☐ Members of the public ☐ Contractor ☐ Other ☐ _____	
Address	
Phone	Email
Incident Details	
What Happened	
Activity at the time of the incident	
Actions taken to make safe	

Fig. 8.1.21: Incident report form

Accident and accident emergency

Accidents and accident emergencies are unplanned incidents that cause injury, illness, property or equipment damage, or disrupt apparel manufacturing operations. Prompt reporting, first aid, emergency response, evacuation where required, and corrective actions help minimise harm and prevent recurrence. The following are the stages of accident and accident emergency reporting:

Stage	Purpose	Procedure	Responsible authority
Accident identification and immediate response	Control the incident and prevent further injury.	Identify the accident, secure the area, provide first aid, and stop work if required.	Employee, First-aid, Supervisor

Stage	Purpose	Procedure	Responsible authority
Accident reporting and notification	Ensure timely reporting and emergency assistance.	Report the accident to the supervisor, safety officer, and organisational authorities; notify emergency services or statutory authorities where required.	Supervisor, Safety Officer, Emergency Services
Rescue and emergency coordination	Protect employees and manage emergency response.	Coordinate rescue, provide emergency assistance, evacuate employees safely, and assist persons with disabilities in accordance with the RPwD Act, 2016.	Emergency Response Team, Fire Department, Medical Services
Accident investigation and documentation	Identify causes and prevent recurrence.	Record the incident, collect witness statements, investigate the root cause, and implement corrective and preventive actions.	Safety Officer, Investigation Team, Management

Table 8.1.4: Accident reporting and response procedures

What is first-aid

First aid is the immediate care provided to an injured or ill person before professional medical assistance arrives. It helps preserve life, prevent the condition from worsening, and support recovery.

Components of a first-aid kit

A first-aid kit contains essential medical supplies such as adhesive bandages, sterile gauze, antiseptic solution, adhesive tape, scissors, gloves, burn dressing, triangular bandage, and a first-aid manual for emergency care. Keeping the kit complete, accessible, and regularly replenished ensures prompt and effective first-aid response.



Fig. 8.1.22: First-aid kit

Types of first-aid

The following are the different types of first aid for different types of first aid given to sudden accidents:

- **Bleeding first aid**

Bleeding first aid involves controlling blood loss by applying direct pressure to the wound using a clean dressing or sterile gauze. Direct pressure is the application of firm, continuous pressure over the wound to control bleeding until medical help is available.



Fig. 8.1.23: bleeding first-aid

- **Burn first aid**

Burn first aid involves immediately cooling the affected area with cool running water for at least 20 minutes and covering it with a sterile, non-stick dressing. Burn cooling reduces heat within the skin, limits tissue damage, and relieves pain.



Fig. 8.1.24: Burn first-aid

- **Electric shock first aid**

Electric shock first aid involves disconnecting the power source safely before touching the injured person and checking for breathing and responsiveness. Safe electrical isolation involves switching off the electrical supply before rescue to prevent further injury.



Fig. 8.1.25: Electric shock first-aid

- **Unconscious person first aid**

First aid for an unconscious person involves checking responsiveness and breathing and placing the person in the recovery position if breathing normally. The recovery position keeps the airway open and reduces the risk of choking while awaiting medical assistance.



- 1 Lay the person down in a safe area and loosen tight clothing.
- 2 Raise the legs above chest level for 10-15 minutes.
- 3 Call for an ambulance if the person does not recover after 20 minutes.

FIRST AID AS EASY AS 1-2-3!

Fig. 8.1.26: Fainting first-aid

- **Fracture and sprain first aid**

First aid for fractures and sprains involves immobilising the injured area, avoiding unnecessary movement, and applying a splint or sling where appropriate. Immobilisation keeps the injured body part stable to prevent further damage until medical treatment is available.



Fig. 8.1.27: Fracture and sprain first-aid

- **Eye injury first aid**

Eye injury first aid involves flushing the eye with clean water if exposed to dust or chemicals and protecting it from further damage. Eye irrigation gently removes contaminants to reduce irritation and minimise eye injury.

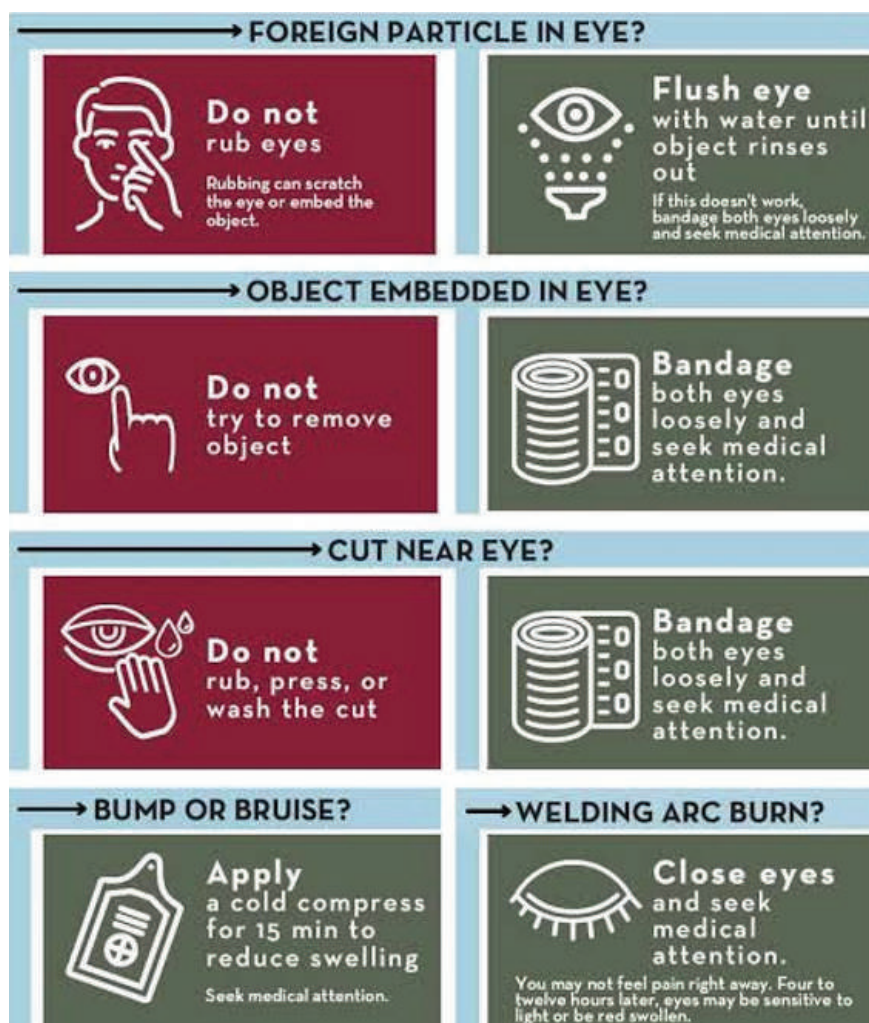


Fig. 8.1.28: Eye-injury first-aid

- **Choking first aid**

Choking first aid involves encouraging the person to cough and performing back blows followed by abdominal thrusts if the airway remains blocked. Back blows and abdominal thrusts help dislodge the obstruction and restore normal breathing.



Fig. 8.1.29: Choking first-aid

- **Chemical exposure first aid**

Chemical exposure first aid involves immediately rinsing the affected skin or eyes with plenty of clean water and removing contaminated clothing. Water flushing dilutes and removes hazardous chemicals to minimise tissue damage.

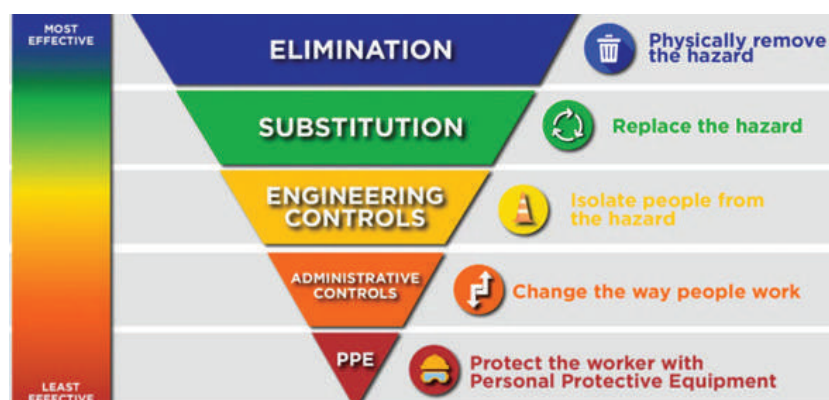
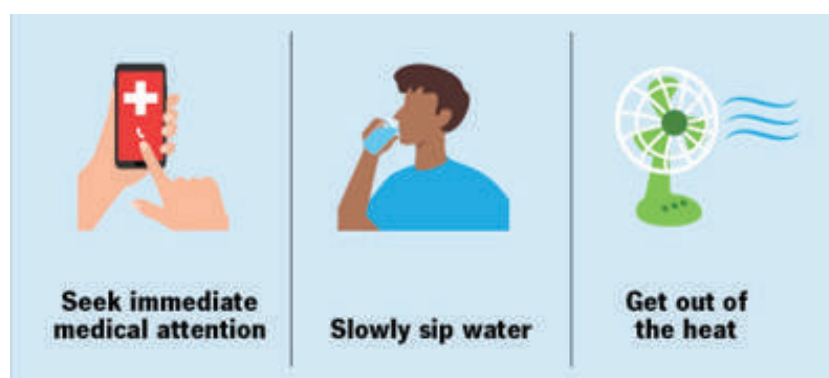


Fig. 8.1.30: Chemical exposure hazard

- **Heat exhaustion first aid**

Heat exhaustion first aid involves moving the affected person to a cool place, providing water, and cooling the body. Active cooling lowers body temperature using cool water, fans, or damp cloths to prevent heat-related illness.



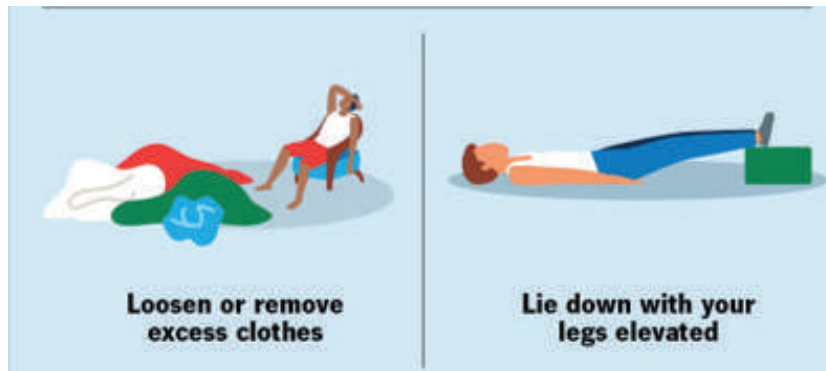


Fig. 8.1.31: Heat exposure hazard

- **Cardiac arrest first aid**

Cardiac arrest first aid involves immediately calling emergency medical services and starting cardiopulmonary resuscitation (CPR) if the person is unresponsive and not breathing normally. Cardiopulmonary resuscitation (CPR) uses chest compressions, with rescue breaths where trained, to maintain blood circulation and oxygen supply until advanced medical care arrives.



Fig. 8.1.32: CPR stages

Fire emergency

A fire emergency is an unexpected fire or fire-related incident that threatens the safety of employees, equipment, property, or production activities in the apparel industry. It requires immediate alarm activation, safe evacuation, firefighting measures where appropriate, and prompt response according to organisational emergency procedures.



Fig. 8.1.33: Fire emergency

What is fire?

Fire is the rapid combustion of combustible materials that produces heat, flames, smoke, and gases. It can cause injuries, property damage, production disruption, and environmental harm if not controlled promptly. The fire triangle is a model that shows fire requires heat, fuel, and oxygen to ignite and continue burning, and removing any one of these elements extinguishes the fire.

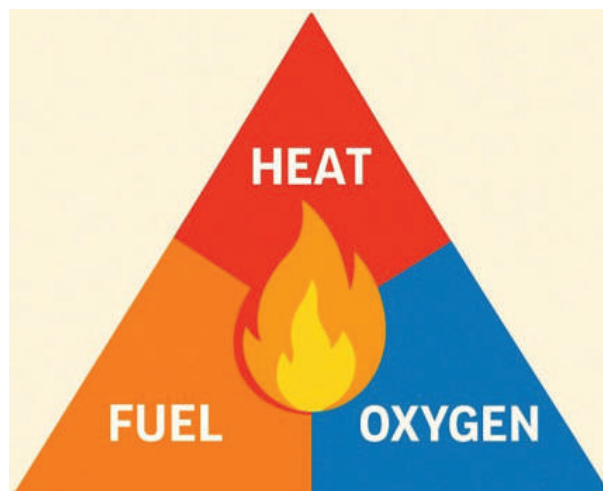


Fig. 8.1.34: Fire triangle

Types of fire

In India, the classification of fires is specified in Bureau of Indian Standards Standard IS 2190: Code of Practice for Selection, Installation and Maintenance of Portable First-Aid Fire Extinguishers, which aligns with internationally accepted fire classes such as the following:

Fire class	Description	Common source in apparel industry
Class A fire	Involves combustible materials such as fabric, cloth, paper, wood, rubber, and plastics.	Fabric rolls, garments, cartons, paper records, and packaging materials.
Class B fire	Involves flammable liquids such as oils, diesel, petrol, solvents, paints, adhesives, and lubricants.	Chemical storage, machine lubrication, printing, and finishing areas.
Class C fire	Involves flammable gases such as LPG, CNG, propane, and butane.	Gas cylinders, pipelines, and gas-operated equipment.
Class D fire	Involves combustible metals such as magnesium, sodium, potassium, aluminium powder, and titanium.	Rare in apparel manufacturing; may occur in specialised industrial processes.
Electrical fire	Involves energised electrical equipment; under BIS IS 2190, power is isolated before extinguishing and the fire is then classified by the burning material.	Sewing machines, cutting machines, motors, switchboards, electrical panels, and wiring.

Table 8.1.5: Classification of fire types

Fire extinguisher and types

A fire extinguisher is a portable fire protection device used to control or extinguish small fires during the early stages of an emergency. It helps prevent the spread of fire, protect life and property, and support emergency response when used according to the appropriate fire class.

Parts of a fire extinguisher

A fire extinguisher is a portable fire protection device used to control or extinguish small fires during the early stages of an emergency. It helps prevent the spread of fire, protect life and property, and support emergency response when used according to the appropriate fire class.



Fig. 8.1.35: Parts of a fire extinguisher

Types of fire extinguisher

According to Bureau of Indian Standards IS 2190: Code of Practice for Selection, Installation and Maintenance of Portable First-Aid Fire Extinguishers, portable fire extinguishers are selected based on the class of fire they are intended to extinguish such as follows:

- **Water fire extinguisher**

Water fire extinguishers are used for Class A fires involving ordinary combustible materials such as wood, paper, cloth, and textiles. They extinguish fire by cooling the burning material and should not be used on electrical or flammable liquid fires.



Fig. 8.1.36: Water-based fire extinguisher

- **Foam fire extinguisher**

Foam fire extinguishers are used for Class A and Class B fires involving combustible materials and flammable liquids. They extinguish fire by forming a foam blanket that cools the surface and prevents oxygen from reaching the fuel.



Fig. 8.1.37: Foam-based fire extinguisher

- **Dry powder (DCP) fire extinguisher**

Dry powder fire extinguishers are suitable for Class A, Class B, Class C, and electrical fires. They extinguish fire by interrupting the combustion process and are commonly used in apparel manufacturing due to their versatility.



Fig. 8.1.38: DCP fire extinguisher

- **Carbon dioxide (CO₂) fire extinguisher**

Carbon dioxide fire extinguishers are used for electrical fires and Class B fires involving flammable liquids. They extinguish fire by displacing oxygen without leaving any residue, making them suitable for electrical equipment.



Fig. 8.1.39: Carbon dioxide fire extinguisher

- **Class D metal fire extinguisher**

Class D fire extinguishers are specially designed for Class D fires involving combustible metals such as magnesium, sodium, potassium, and aluminium powder. They extinguish fire using specialised dry powder agents formulated for metal fires.



Fig. 8.1.40: Class-D metal fire extinguisher

What is emergency shutdown

Emergency shutdown is the immediate and controlled stopping of machinery, equipment, utilities, or production processes during an emergency to prevent injuries, equipment damage, or the spread of hazards. It helps protect employees, minimise risks, and ensure safe evacuation in accordance with organisational emergency procedures. An emergency shutdown system is a safety system that automatically or manually stops machinery, equipment, or production processes during an emergency to prevent injuries, equipment damage, and the escalation of hazards.



Fig. 8.1.41: Emergency shutdown system

Organisational procedures for emergency shutdown

The Occupational Safety, Health and Working Conditions (OSH) Code, 2020 requires employers to establish emergency shutdown procedures to safely stop operations, control hazards, and protect employees during workplace emergencies. The following are the common organisational procedures for emergency shutdown:

- **Emergency identification**
Fire, electrical faults, chemical spills, equipment failures, or other hazards are identified promptly, and authorised personnel initiate the emergency shutdown.
- **Safe system shutdown**
Machinery, utilities, and electrical systems are shut down using approved procedures, and energy sources are safely isolated to prevent further hazards.
- **Evacuation and emergency response**
Employees evacuate through designated routes to assembly points, while persons with disabilities are provided reasonable accommodation in accordance with the Rights of Persons with Disabilities (RPwD) Act, 2016. Emergency teams provide first aid, firefighting, rescue, and coordinate with external emergency services where required.
- **Incident reporting and recovery**
The incident is documented, corrective actions are implemented, and operations resume only after authorised safety clearance.

8.1.4 Health Hygiene Safe Work Practices

Health hygiene safe work practices involve maintaining personal health, workplace hygiene, and safe habits to prevent illness, injuries, and occupational health risks in apparel manufacturing. The apparel quality analyst uses the health, hygiene, and safe work practices checklist in accordance with the Occupational Safety, Health and Working Conditions (OSH) Code, 2020 and organisational health and hygiene requirements.

The following are the stages of health, hygiene safe work practices:

- **Good hygiene practices (GHP)**

Good hygiene practices involve maintaining both personal hygiene and workplace hygiene by following cleanliness and sanitation procedures during work. These practices help prevent contamination, reduce the spread of illness, and maintain a safe, healthy, and hygienic workplace.



Fig. 8.1.42: Good hygiene practices (GHP)

- **Healthy lifestyle practices**

Healthy habits such as balanced nutrition, regular physical activity, adequate rest, and stress management are encouraged to maintain physical and mental well-being. A healthy lifestyle improves work performance, concentration, and overall productivity.



Fig. 8.1.43: Healthy lifestyle practices

- **Substance abuse prevention**

The harmful effects of alcohol, tobacco, and drugs on health, safety, judgment, and workplace performance are recognised and avoided. Employees are encouraged to remain free from intoxicants to ensure safe and responsible working practices.

Intoxicant	Ill-effects	Methods to reduce dependency
Alcohol	Impairs judgement, slows reaction time, reduces coordination, increases accident risk, and affects productivity and health.	Seek counselling, participate in de-addiction programmes, avoid triggers, and adopt healthy lifestyle habits.
Tobacco	Causes respiratory diseases, heart disease, cancer, reduced stamina, and passive smoking risks in the workplace.	Use tobacco cessation programmes, nicotine replacement therapy under medical guidance, and avoid tobacco use at work.
Drugs	Impair concentration, decision-making, coordination, and behaviour, increasing the risk of accidents and poor work performance.	Seek professional medical treatment, rehabilitation services, counselling, and peer or family support.

Intoxicant	Ill-effects	Methods to reduce dependency
Other intoxicants	Reduce alertness, impair physical and mental performance, and increase the likelihood of workplace injuries and unsafe behaviour.	Maintain a healthy lifestyle, manage stress through positive activities, and seek timely professional support to prevent dependency.

Table 8.1.5: Effects of intoxicants and prevention

- **Safe workplace behaviour**

Safe work habits such as maintaining cleanliness, following organisational procedures, using personal protective equipment, and practising good housekeeping are followed during apparel manufacturing. These practices reduce workplace hazards and support a safe and healthy work environment.



Fig. 8.1.44: Safe workplace behaviour categories

- **Mitigating risks in owning action**

Owning actions, such as maintaining clean workstations, following organisational safety procedures, and correctly using personal protective equipment, are strictly practiced to uphold individual accountability. These deliberate habits significantly minimise physical hazards, directly supporting a secure and healthy work environment for both self and others.



Fig. 8.1.45: Mitigating stages by owning actions

- Safety signage and symbol implementation**

Safety signage and symbol implementation involve displaying standard safety signs and symbols to communicate hazards, mandatory precautions, emergency information, and safe work practices in the workplace. They help prevent accidents, guide emergency response, and ensure compliance with workplace safety regulations.

Categories	Sign			
	Meaning (Code)			
Mandatory signs				
	Wear Safety Helmet (M1)	Wear Protective Footwear (M2)	Wear Safety Harness (M3)	Wear Eye Protection (M4)
	No Smoking (P5)	No Naked Flames (P6)	Do Not Use This Lift (P7)	No Entry (P8)
Emergency signs				
	First Aid (E9)	Drinking Water (E10)	Emergency Telephone (E11)	Emergency Stop (E12)

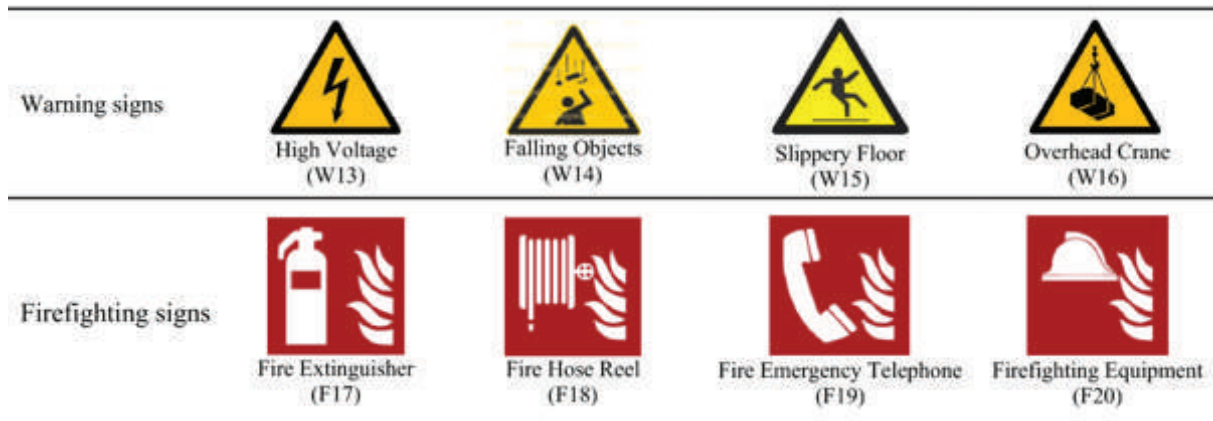


Fig. 8.1.46: Safety signage and symbols

- **Safety and emergency numbers usage**

Safety and emergency numbers usage involves knowing and using the appropriate emergency contact numbers to report accidents, fires, medical emergencies, and other workplace incidents promptly. Timely communication with the relevant emergency services helps minimise risks, protect lives, and ensure an effective emergency response.

Emergency service	Emergency number	Purpose
National Emergency Response Support System (ERSS)	112	Single emergency number for police, fire, and ambulance services.
Fire and Rescue Service	101	Report fires, explosions, and rescue emergencies.
Ambulance Service	108	Medical emergencies and ambulance assistance.
Police	100	Report crimes, violence, theft, and law-and-order emergencies.
Women Helpline	1091	Assistance for women in distress and emergencies.
Child Helpline	1098	Emergency support for children in need of care and protection.
Disaster Management / Relief	1078	Assistance during natural disasters and major emergencies (where operational).
State/District Emergency Control Room	1077	Emergency coordination during disasters at the district or state level.

Table 8.1.6: Important Indian emergency contact numbers

- **Inclusive health support**

Health, hygiene, and workplace facilities are made accessible to persons with disabilities through appropriate support and reasonable accommodation. These measures are implemented in accordance with the Rights of Persons with Disabilities (RPwD) Act, 2016 to promote an inclusive, healthy, and safe workplace.

Health financing and
governance

Digital and mobile
healthcare facilities

PwD accessible
toilets

PwD facilitated
parking lots

Inclusive emergency
care

Fig. 8.1.47: Inclusive health support components

8.1.5 Quality Standards Legal Compliance Procedures

Quality standards and legal compliance procedures involve following applicable quality standards, legal requirements, and organisational procedures during apparel manufacturing. They help ensure regulatory compliance, consistent product quality, and adherence to customer and industry requirements. The following are the different compliance standards practised in the apparel industry:

Compliance area	Relevant Indian law / standard	Compliance procedure
Product quality	Bureau of Indian Standards (BIS) Act, 2016	Verify garments against approved specifications, measurements, workmanship, and applicable BIS standards.
Workplace health and safety	Occupational Safety, Health and Working Conditions (OSH) Code, 2020	Follow safety procedures, use PPE, inspect equipment, and report workplace hazards.
Environmental management	Environment (Protection) Act, 1986	Segregate waste, prevent pollution, conserve resources, and follow environmental procedures.
Chemical safety	Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989	Handle, store, label, and dispose of chemicals according to safety requirements.
Labour welfare	Code on Wages, 2019 and Code on Social Security, 2020	Comply with organisational policies on wages, working conditions, and employee welfare.
Accessibility and inclusion	Rights of Persons with Disabilities (RPwD) Act, 2016	Provide accessible workplaces, reasonable accommodation, and safe evacuation for persons with disabilities.
Quality management	ISO 9001:2015 Quality Management System	Maintain quality records, implement corrective actions, and ensure process traceability.
Persons with disabilities (PwD) inclusion	Persons with disabilities (PwD) inclusion	Persons with disabilities (PwD) inclusion

Table 8.1.7: Apparel quality compliance requirements

UNIT 8.2: Equipment Operations and Documentation

Unit Objectives

By the end of this unit, the participants will be able to:

1. Outline the procedures for obtaining work instructions, interpreting job cards, clarifying task requirements, and achieving assigned work targets.
2. Describe the methods for inspecting tools, equipment, work areas, and finished products to ensure safety, operational readiness, and quality compliance.
3. Prepare workplace records, forms, and reports on equipment status, safety observations, defects, and production activities.
4. Explain the procedures for reporting defective tools, machine malfunctions, workplace hazards, and quality issues to the appropriate personnel.

8.2.1 Work Instructions Sheets

Work instruction sheets provide procedures for obtaining work instructions, interpreting job cards, clarifying task requirements, and completing assigned work targets. They help apparel quality analysts perform tasks correctly, maintain process compliance, and achieve production and quality objectives. They are of the following types:

- **Work ticket**

A work ticket is a production document that contains garment style details, bundle information, operation sequence, quantity, and production specifications. The apparel quality analyst obtains and verifies the work ticket to confirm production details, batch identification, and inspection requirements before starting quality checks. The verified information is used to carry out inspections and quality control activities in line with the responsibilities of the job role.

Client Name		Work Order Date	Work Order Number
Client Phone			
Client Email		Expected Start Date	Expected End Date
Order Received By			
Service Location			

Job Description			
LABOR DESCRIPTION	PRIORITY		
MATERIAL DESCRIPTION	QUANTITY		



Fig. 8.2.1: Work ticket

- **Job card**

A job card is a work instruction document that specifies the assigned task, process requirements, quality standards, production targets, and operator details. The apparel quality analyst obtains and checks the job card to understand inspection requirements, quality specifications, and assigned responsibilities before performing the task. The verified information is used to carry out inspection and quality assurance functions in accordance with the job role and organisational procedures.

Job card Number		Requested By
Department		Completed By
Date Received		Permit Required(Y/N)
Date Completed		Permit Number
Time Started		
Time Completed		

TYPE OF WORK	REMARKS	TOOLS REQUIRED

Job card Number		Requested By
Department		Completed By
Date Received		Permit Required(Y/N)
Date Completed		Permit Number
Time Started		
Time Completed		

TYPE OF WORK	REMARKS	TOOLS REQUIRED

Maintenance Signature	
Line Manager Signature	

Fig. 8.2.2: Job card

What are work execution and documentation procedures?

Work execution and documentation procedures are the processes of performing assigned tasks according to work instructions, production targets, and organisational requirements while maintaining workplace safety and quality standards. They ensure accurate record-keeping, production traceability, effective communication, and compliance with organisational procedures. The following are the stages:

Practice area	Description
Job task execution practices	Obtain and verify work ticket or job card details and perform assigned tasks according to job role responsibilities. Clarify instructions when required to ensure correct task execution.

Practice area	Description
Work planning and completion procedures	Review work instructions, confirm targets with supervisors, and follow special instructions before starting tasks. Complete work safely and ensure the workplace is left secure after completion.
Production task management practices	Carry out operations at the required pace to maintain workflow and achieve production targets. Monitor task progress to minimise delays and improve production efficiency.
Work instruction and reporting procedures	Follow approved work instructions and complete required forms, records, and documentation. Maintain accurate reporting to support communication, traceability, and compliance.
Work target achievement practices	Agree, review, and monitor work targets with supervisors to achieve planned output and quality requirements. Ensure tasks are completed within defined timelines and organisational standards.

Table 8.2.1: Work execution and completion practices

8.2.2 Tools Equipment Workplace Inspection

Tools, equipment, and the work area to ensure they are safe, functional, and suitable for apparel manufacturing activities. It helps apparel quality analysts maintain workplace safety, prevent defects, and ensure uninterrupted production. The following are the components of tools, equipment and workplace inspection for proper functions:

- **Work area inspection**

Work area inspection involves checking the workplace to ensure it is clean, hazard-free, and ready for apparel manufacturing activities. It helps maintain workplace safety, prevent accidents, and ensure uninterrupted production.



Fig. 8.2.3: Production work area

The following table outlines the work area inspection procedures for the main work areas in apparel manufacturing:

Work area	Work area inspection procedure
Fabric inspection and storage area	Ensure the area is clean, well-lit, and free from hazards. Set up the fabric inspection machine, inspection table, and storage racks according to the inspection requirements.
Cutting and preparation area	Ensure cutting tables, cutting machines, spreading equipment, and surrounding areas are clean, safe, and free from obstructions. Verify machine settings and pattern availability before cutting operations.
Sewing and production area	Ensure sewing workstations, machines, electrical connections, and operator areas are safe and organised. Verify machine readiness and remove any unsafe conditions before production.
Finishing and packing area	Ensure pressing, trimming, finishing, and packing equipment are clean, functional, and safely arranged. Verify workstations and equipment before garment finishing and packing activities.
Quality inspection and testing area	Ensure inspection tables, measuring tools, lighting, and testing equipment are clean, calibrated, and ready for inspection. Remove hazards and verify inspection equipment before quality evaluation.
Storage and dispatch area	Ensure storage racks, packing materials, dispatch areas, and access routes are clean, organised, and free from hazards. Verify safe handling equipment and proper storage conditions before dispatch.

Table 8.2.2: Apparel work area inspection procedures

- **Safe tool operation**

Safe tool operation involves selecting, inspecting, and using the correct tools and equipment according to manufacturer and organisational procedures. It helps prevent injuries, protect equipment, and maintain consistent production quality. The following table outlines the safe tool operation and inspection procedures for commonly used apparel manufacturing equipment:

Equipment	Safe tool operation and inspection procedure
Cutting machine	Verify blade sharpness, guard condition, alignment, and emergency stop before operation. Operate with appropriate PPE and inspect the machine for safe cutting performance after use.
Sewing machine	Check needle condition, thread tension, stitch settings, and safety guards before use. Operate according to manufacturer instructions and inspect for smooth stitching and safe functioning.
Overlock machine	Verify thread path, knife condition, stitch formation, and protective guards before operation. Inspect seam quality and machine condition to ensure safe and consistent performance.
Flatlock machine	Check needle, looper, thread tension, and machine settings before use. Inspect seam appearance and machine operation to maintain safety and quality.

Equipment	Safe tool operation and inspection procedure
Button attaching machine	Verify button attachment settings, needle condition, and machine alignment before operation. Inspect button security and machine performance after use.
Buttonhole machine	Check knife condition, stitch density, buttonhole dimensions, and safety devices before operation. Inspect buttonhole quality and machine condition during production.
Zipper attaching machine	Verify zipper guide, needle, stitch settings, and machine alignment before use. Inspect zipper attachment quality and safe machine operation throughout production.
Pressing and finishing machine	Check temperature, pressure, steam settings, and electrical connections before operation. Inspect controls and safety devices to prevent burns and ensure proper garment finishing.
Inspection machine	Verify lighting, rollers, fabric movement, and electrical components before use. Inspect machine performance regularly to ensure accurate defect detection and safe operation.

Table 8.2.3: Apparel equipment operation and inspection procedures

8.2.3 Workplace Records Forms Reports

Workplace records, forms, and reports are documents used to record production activities, inspection findings, quality data, equipment status, and workplace incidents in apparel manufacturing. They help apparel quality analysts maintain traceability, ensure process compliance, and support effective communication and decision-making.

Date		Company logo	
Company name			
Department/Location			
Project name			
Manager/Supervisor		Report No.	
Progress overview			
Tasks completed			
Tasks in progress			
Tasks on hold			
Blocked tasks			
Delays/Blockers/Incidents			
Resources			
Workers' list	Equipment	Material	Budget/Expenses

Fig. 8.2.4: Workplace record sample template

The following are the stages of maintaining workplace records, forms, and reports:

- **Work planning and preparation**

Before starting work, the work instruction sheet is obtained to outline work planning and preparation and assigned tasks. It ensures materials, tools, equipment, and resources are ready for uninterrupted production.

- **Continuous workflow maintenance**

During production, the production monitoring sheet is used to record continuous workflow maintenance and operational progress. It helps maintain continuous workflow, minimise delays, and improve productivity.

- **Production target achievement**

At scheduled intervals, the hourly production report is used to record production target achievement against planned output. It helps monitor productivity, identify deviations, and ensure timely target achievement.

- **Quality and process monitoring**

Throughout production, the inspection report is used to record quality and process monitoring findings, including defects, measurements, and quality observations. It verifies quality compliance, supports defect prevention, and maintains traceable quality records.

- **Work completion and reporting**

After task completion, the production completion report is used to record work completion and reporting details, including completed quantities and inspection status. It supports production traceability, performance evaluation, and continuous improvement.

8.2.4 Defect Hazard Reporting Procedures

A defect hazard is a product, process, or workplace defect that may compromise garment quality, worker safety, or production efficiency if left uncorrected. Defect hazard reporting is the process of identifying, documenting, and communicating quality defects or workplace hazards to enable timely corrective and preventive actions. The following are the types of defect reporting forms:

- **Defect reports**

Defect reports are quality records used to document garment defects such as fabric faults, stitching errors, measurement variations, and finishing issues identified during inspection. They help apparel quality analysts track defects, analyse trends, and implement corrective actions.

Project Name			Program Manager
Defect No.	Date Created	Created By	Defect Description
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Fig. 8.2.5: Defect report sample template

- **Non-conformance reports (NCRs)**

Non-conformance reports (NCRs) are formal quality documents used to record deviations from approved specifications, quality standards, or production requirements. They help identify the cause of non-conformities, assign corrective actions, and ensure compliance with quality requirements.

NCR #	Client:	File No	
Function/Area/Process:		Site:	
Std. and Clause No(s):			
Section 1- Details of non-conformity:			
Description			
Auditor :		Auditee representative acknowledgement:	Category:
Date:			
Section 2- Auditee Proposed Action Plan (Attach separate sheet if required)			
Root Cause analysis (how/why did this happen?):			
Correction (fix now) with completion dates:			
Corrective Action (to prevent recurrence) with completion dates:			
"Auditor" review and acceptance of Corrective Action Plan:			
Auditee representative:		Date:	
Section 3- Details of "Auditor" verification of Auditee implementation of action plan			
Section 4- NCR closed out by "Auditor" on (date):		"Auditor" Team Leader name:	

Fig. 8.2.6: Non-conformance report

The following are the procedures of defect hazard reporting:

Stage	Defect hazard type	Reporting and resolution procedure
Defect identification	Fabric defects, stitching defects, measurement variations, finishing defects, and non-conformities	Visual inspection is performed to identify defects, record defect details, and report quality deviations.

Stage	Defect hazard type	Reporting and resolution procedure
Defect documentation	Product defects, process defects, and repeated quality issues	Defects are recorded using defect reports, inspection sheets, and non-conformance reports for corrective action.
Defect assessment	Critical defects, safety hazards, and major non-conformities	Defects are evaluated based on severity and impact, and critical issues are escalated for resolution.
Root cause analysis	Machine defects, material issues, and process variations	Defect causes are analysed, and corrective and preventive actions are implemented to avoid recurrence.
Verification and closure	Recurring defects and unresolved quality issues	Corrective actions are verified through re-inspection, and defect records are closed after compliance confirmation.
Irreversible service fault reporting	Irreparable machine faults, equipment breakdowns, and critical service malfunctions.	Faults that cannot be rectified are immediately reported to the supervisor or maintenance team using the prescribed reporting procedure for repair or replacement.

Table 8.2.4: Defect hazard reporting procedures

UNIT 8.3: Quality Environment and Sustainability

Unit Objectives

By the end of this unit, the participants will be able to:

1. Discuss the impact of contamination, including machine oil, dirt, and improper handling, on garment quality and production.
2. Compare methods of waste reduction, material reuse, and safe waste disposal to support sustainable manufacturing practices.
3. Elaborate on the role of workplace safety, environmental responsibility, proper documentation, and housekeeping in improving productivity, product quality, and employee well-being.

8.3.1 Contamination Effects on Garment Quality

Garment contamination refers to the presence of unwanted substances, particles, or foreign materials on fabrics, trims, or finished garments during manufacturing and handling. It affects garment appearance, hygiene, performance, and customer acceptance by causing defects, quality failures, and product rejection. The following are the different types of contamination affecting garment quality:

- **Oil and grease contamination**

Oil and grease contamination occurs when machine lubricants, handling oils, or maintenance residues come into contact with fabrics or garments. It causes stains, discolouration, and poor appearance, affecting garment cleanliness and final quality.



Fig. 8.3.1: Oil and grease contamination

- **Dust and fibre contamination**

Dust and fibre contamination occurs due to airborne particles, loose fibres, and poor workplace cleanliness during production. It affects garment surface appearance, creates visible marks, and reduces product presentation quality.



Fig. 8.3.2.: Dust and fibre contamination in fabric

- **Chemical contamination**

Chemical contamination occurs when dyes, cleaning agents, finishing chemicals, or other substances are incorrectly handled during production. It may cause colour changes, fabric damage, skin irritation risks, and non-compliance with quality requirements.



Fig. 8.3.3: Chemical (dye) contamination on fabric

- **Water and moisture contamination**

Water and moisture contamination occurs due to improper storage, humidity, or exposure to wet conditions. It can cause mildew, odour, colour bleeding, and fabric deterioration, reducing garment durability and acceptance.



Fig. 8.3.4: Water and moisture contamination on fabric

- **Foreign material contamination**

Foreign material contamination occurs when unwanted objects such as metal pieces, threads, packaging materials, or personal items enter the garment production process. It affects garment safety, appearance, and customer satisfaction.



Fig. 8.3.5: Foreign material contamination on fabric

- **Biological contamination**

Biological contamination occurs due to microorganisms, sweat, dirt, or improper hygiene practices during handling and storage. It can cause unpleasant odours, hygiene issues, and reduced garment quality.



Fig. 8.3.6: Biological contamination on fabric

8.3.2 Waste Reduction and Material Reuse

Waste reduction and material reuse refer to practices that minimise the generation of waste and maximise the use of available resources by reusing, recycling, or repurposing materials. These practices help conserve natural resources, reduce environmental impact, lower operational costs, and promote sustainable resource management. A suitable model for Waste Reduction and Material Reuse is the

3R Model – Reduce, Reuse, and Recycle. Reduce minimises waste through efficient material use, reuse extends material life by using resources again, and recycle converts waste into reusable materials to conserve resources and reduce environmental impact.



Fig. 8.3.7: 3R Model - Reduce, reuse, and recycle

The following are the different types of materials used in the apparel industry, and the methods to reduce waste and reuse the materials:

- **Fabric materials**

Fabric waste is reduced by accurate pattern planning, marker optimisation, digital cutting, and efficient fabric utilisation during cutting operations. Fabric scraps and leftover materials are reused for sampling, accessories, patchwork, smaller garment components, or recycled into new textile products.

Fabric waste	Waste reduction method	Waste reduction and material reuse practice
	Accurate pattern planning	Arrange pattern pieces efficiently to minimise fabric waste and reuse fabric scraps for sampling and small garment components.
	Marker optimisation	Optimise marker layouts to maximise fabric utilisation and use leftover fabric for accessories and patchwork products.
	Digital cutting	Use computer-controlled cutting to improve cutting accuracy, reduce waste, and recycle usable off-cuts into new textile products.
	Efficient fabric utilisation	Plan fabric usage effectively to minimise wastage and repurpose leftover materials for secondary production or authorised recycling.
	Waste reduction method	Waste reduction and material reuse practice

Table 8.3.1: Fabric waste reduction practices

- **Trims and accessories**

Trim waste is reduced by accurate consumption planning, controlled issuing, and proper inventory management of buttons, zippers, labels, and threads. Unused trims are reused in sample development, repair activities, or future production orders where specifications match.

Trim and accessory waste	Waste reduction method	Waste reduction and material reuse practice
	Accurate consumption planning	Estimate trim requirements accurately to minimise wastage and reuse unused trims for sample development and repair activities.
	Controlled issuing	Issue only the required quantity of trims to reduce excess consumption and reuse remaining trims in future production where specifications match.
	Proper inventory management	Monitor stock levels of buttons, zippers, labels, and threads to prevent overstocking and utilise available trims efficiently.
	Trim segregation and storage	Segregate and store reusable trims properly to maintain quality and facilitate reuse in subsequent production orders.

Table 8.3.2: Trim and accessory waste reduction practices

- **Packaging materials**

Packaging waste is reduced by using the required quantity of cartons, polybags, tags, and packing materials through proper planning and standardised packing methods. Packaging materials such as cartons, plastic containers, and bags are reused for storage, transportation, or internal material handling

Packaging materials waste	Waste reduction method	Waste reduction and material reuse practice
	Accurate packaging planning	Plan packaging requirements accurately to minimise wastage and optimise the use of cartons, polybags, tags, and other packing materials.

Packaging materials waste	Waste reduction method	Waste reduction and material reuse practice
	Standardised packing methods	Follow standard packing procedures to reduce excess packaging material consumption and improve packing efficiency.
	Controlled material usage	Issue only the required quantity of packaging materials and minimise unnecessary consumption during packing operations.
	Packaging material reuse	Reuse cartons, plastic containers, and bags for storage, transportation, and internal material handling wherever suitable.

Table 8.3.3: Packaging waste reduction practices

- Cutting waste and fabric scraps**

Cutting waste is reduced through computerised marker planning, nesting techniques, and optimisation of cutting layouts to minimise leftover fabric. Suitable fabric scraps are reused for small garment parts, testing, cleaning cloths, or converted into recycled textile materials.

Cutting waste and fabric scraps	Waste reduction method	Waste reduction and material reuse practice
	Computerised marker planning	Use computerised marker planning to minimise cutting waste and maximise fabric utilisation.
	Nesting techniques	Arrange pattern pieces efficiently to reduce leftover fabric during cutting operations.
	Cutting layout optimisation	Optimise cutting layouts to minimise fabric wastage and improve material utilisation.
	Fabric scrap reuse	Reuse suitable fabric scraps for small garment parts, testing, cleaning cloths, or recycling into textile materials.

Table 8.3.4: Cutting waste and fabric scrap reduction practices

- Paper and documentation materials**

Paper waste is reduced by using digital records, electronic quality reports, and online documentation systems instead of unnecessary printing. Used paper materials are reused for internal notes, drafts, or recycled through authorised waste management systems.

Paper and documentation materials waste	Waste reduction method	Waste reduction and material reuse practice
	Digital record management	Maintain digital records to minimise paper consumption during documentation and reporting.
	Electronic documentation	Use electronic quality reports and online documentation systems instead of unnecessary printing.
	Controlled paper usage	Print only when required and optimise paper use for official documentation.
	Paper reuse and recycling	Reuse paper for internal notes and drafts, and recycle used paper through authorised waste management systems.

Table 8.3.5: Paper and documentation waste reduction practices

- **Chemical and processing materials**

The Chemical Stock Bin Card records chemical receipts, issues, and stock balances, supporting efficient chemical use, container reuse where permitted, and environmentally compliant recycling or disposal.

Bin Card

[illegible]

Fig. 8.3.8: Chemical stock bin card

The Material Safety Data Sheet (MSDS) provides instructions for the safe handling, storage, use, and disposal of chemicals, helping prevent spills, overuse, and contamination. It supports waste reduction, efficient material utilisation, safe container reuse where permitted, and environmentally compliant disposal.

MSDS (MATERIAL SAFETY DATA SHEET) RECORD SHEET

[illegible]

Fig. 8.3.9: Material safety data sheet (MSDS)

Chemical waste is minimised through controlled usage, accurate measurement, and inventory monitoring using a Chemical Stock Bin Card during dyeing, printing, and finishing operations.

Chemical category	Examples	Chemical waste management practice
Dyes	Reactive dyes, disperse dyes, pigment dyes	Minimise waste through controlled usage, accurate measurement, and inventory monitoring using a Chemical Stock Bin Card. Store and handle chemicals according to the Material Safety Data Sheet (MSDS).
Printing chemicals	Printing paste, pigments, binders, thickeners	Prepare only the required quantity, monitor stock using a Chemical Stock Bin Card, and follow MSDS instructions for handling and storage.
Bleaching chemicals	Hydrogen peroxide, sodium hypochlorite	Use controlled dosing, maintain stock records through a Chemical Stock Bin Card, and store safely according to the MSDS.
Finishing chemicals	Softeners, resins, water repellents, silicone finishes	Optimise chemical application, prepare only the required quantity, maintain inventory using a Chemical Stock Bin Card, and follow MSDS requirements.
Cleaning chemicals	Detergents, stain removers, machine cleaners	Use measured quantities, avoid excess consumption, monitor inventory through a Chemical Stock Bin Card, and comply with MSDS guidelines.
Solvents	Acetone, isopropyl alcohol, cleaning solvents	Dispense controlled quantities, keep containers sealed, maintain stock records using a Chemical Stock Bin Card, and handle according to the MSDS.

Chemical category	Examples	Chemical waste management practice
Adhesives	Fabric glue, bonding adhesive, hot-melt adhesive	Apply only the required amount, monitor inventory with a Chemical Stock Bin Card, and store in accordance with MSDS instructions.
Lubricants and machine oils	Sewing machine oil, gear oil, lubricating grease	Use measured quantities during maintenance, prevent leakage, maintain stock through a Chemical Stock Bin Card, and store safely following the MSDS.

Table 8.3.6: Chemical waste reduction practices

8.3.3 Workplace Safety Environmental Responsibility

Workplace safety environmental responsibility involves following safety practices and environmental procedures to protect employees, resources, and the surrounding environment during apparel manufacturing. It helps prevent workplace hazards, reduce environmental impact, ensure regulatory compliance, and promote sustainable production practices.

WORKPLACE SAFETY CHECKLIST

- 01  Identify workplace hazards
- 02  Review work areas and equipment
- 03  Include relevant safety requirements
- 04  Consult employees and supervisors
- 05  Define inspection frequency based on risk levels
- 06  Review and update the checklist regularly

Fig. 8.3.10: Workplace safety and environmental responsibility checklist sample template

The following are the different methods of ensuring workplace safety and maintaining environmental responsibility:

- **Work area safety preparation**

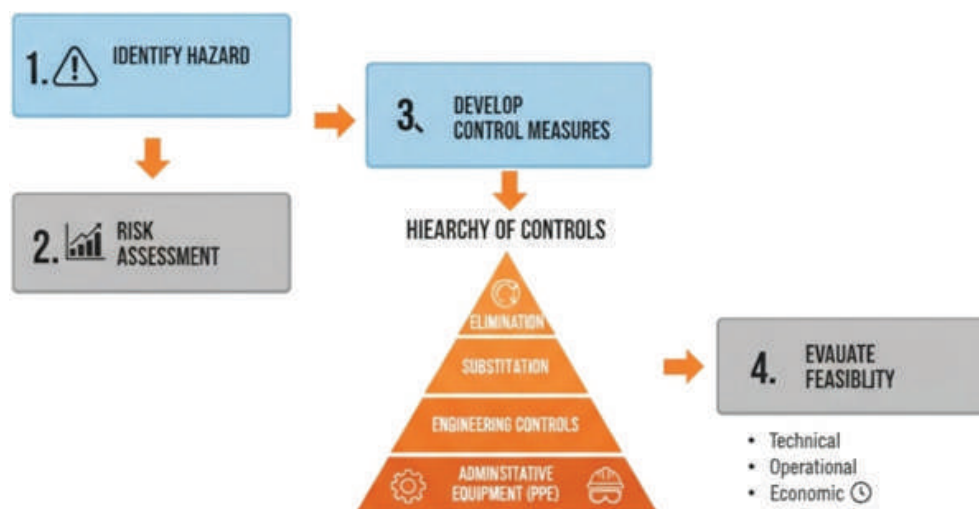
The work area is inspected to identify hazards, remove obstructions, and ensure safe workplace conditions before starting operations. Equipment, machinery, tools, and materials are arranged according to organisational procedures and manufacturer requirements to support safe work practices.



Fig. 8.3.11: workspace safety identifiers

- **Hazard reporting and control**

Workplace risks, equipment malfunctions, and safety concerns are promptly reported through organisational reporting procedures. Supervisors or authorised personnel are consulted for clarification and corrective actions when hazards cannot be resolved independently.



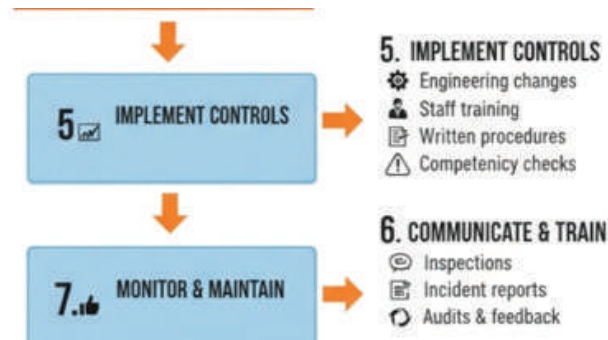


Fig. 8.3.12: Hazard reporting process

- Emergency response and safety management**

Emergency response, communication, evacuation, workplace risk management, and waste disposal are carried out according to organisational procedures to protect employees, control hazards, and ensure accessible emergency support for persons with disabilities. Regular safety inspections, prompt reporting, corrective actions, and safe work practices maintain workplace safety, regulatory compliance, and continuous improvement.

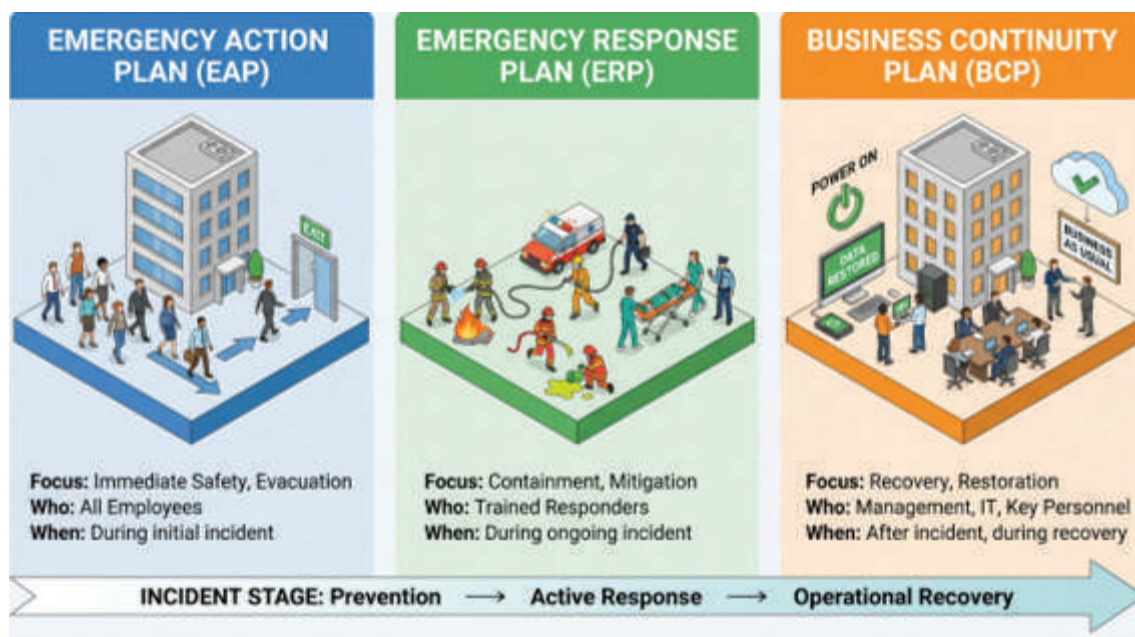


Fig. 8.3.13: Emergency response management

- Emergency mock drill and simulations**

Emergency mock drills and simulations are planned practice exercises conducted to prepare employees for responding to workplace emergencies such as fire, accidents, equipment failures, and evacuations. They help employees understand emergency procedures, improve response time, and ensure safe evacuation in accordance with organisational safety requirements.

Attach to this form a list of all staff who participated in the drill, and any visitors participating.

Time Alarm Sounded: 9.45 am	Time Drill Concluded: 10.00 am	Time to Evacuate: (fire evacuation drills only)
Type of Drill: ☐ Fire / Evacuation ☐ Lockdown ☐ Modified Lockdown ☐ Shelter-in-Place ☐ Earthquake ☐ Tsunami ☐ Medical Emergency ☐ Weather Emergency ☐ Other: _____	Notification / Alert Method: ☐ Bell or Buzzer ☐ Enhanced Alert System ☐ Intercom ☐ Phone ☐ Voice Notification ☐ Siren ☐ Other: _____	Weather Conditions: ☐ Clear ☐ Cloudy ☐ Raining ☐ Rain and wind ☐ Windy ☐ Snow / Sleet ☐ Hail
Participants: (check all that apply) ☐ Senior Management ☐ Safety Personnel ☐ Employees/Staff ☐ Security Officers ☐ Law Enforcement ☐ Fire Department ☐ Emergency Medical Services ☐ Other: _____	Situation at Start of Drill: ☐ Before Business Hours ☐ During Business Hours ☐ Peak Business Hours ☐ Lunch Time ☐ After Business Hours ☐ Other: _____	
Management previously trained on emergency procedures this year? ☐ Yes ☐ No	Employees previously trained on emergency procedures this year? ☐ Yes ☐ No	
Prepared By		Approved By

Fig. 8.3.14: Type of mock drills and learning simulations

Summary

- Safe work practices ensure the proper operation, cleaning, maintenance, and storage of tools, equipment, and machinery.
- Workplace health, safety, environmental, and organisational procedures help maintain a safe and efficient working environment.
- Contamination from machine oil, dirt, and improper handling can reduce garment quality and increase production defects.
- Workplace hazards, accidents, and emergencies must be identified and managed through proper response, evacuation, and reporting procedures.
- Work instructions and job cards help employees understand task requirements and achieve production targets.
- Regular inspection of tools, equipment, work areas, and finished products ensures safety, operational readiness, and quality compliance.
- Workplace records, inspection forms, and reports support equipment monitoring, defect tracking, and production documentation.
- Waste reduction, material reuse, and safe waste disposal promote sustainable and environmentally responsible manufacturing.
- Good health, personal hygiene, and safe work habits improve employee well-being and workplace safety.
- Defective tools, machine malfunctions, workplace hazards, and quality issues should be reported promptly to the appropriate personnel.
- Following organisational quality standards, legal requirements, and standard operating procedures ensures safe and efficient production.
- Workplace safety, environmental responsibility, proper documentation, and good housekeeping improve productivity, product quality, and employee well-being.

Exercise

Multiple-choice Question:

1. Why are safe work practices important in the apparel workplace?
 - a. To increase production costs
 - b. To ensure safe operation of tools and equipment
 - c. To reduce worker attendance
 - d. To increase paperwork

2. What can contaminate garments during production?
 - a. Machine oil and dirt
 - b. Correct stitching
 - c. Proper handling
 - d. Clean workstations

3. Why are tools and equipment inspected regularly?
 - a. To improve advertising
 - b. To ensure safety and quality compliance
 - c. To reduce employee training
 - d. To increase production delays

4. What is the purpose of workplace records and reports?
 - a. To monitor safety, defects, and production activities
 - b. To calculate employee salaries
 - c. To prepare marketing plans
 - d. To record customer complaints only

5. Why should organisational quality standards and SOPs be followed?
 - a. To increase production waste
 - b. To ensure safe and efficient production
 - c. To reduce quality inspections
 - d. To increase machine breakdowns

Descriptive Questions:

1. Explain the importance of safe work practices and workplace health and safety procedures in apparel manufacturing.
2. Describe the effects of contamination, workplace hazards, and emergency response procedures on production quality and safety.
3. Explain the importance of work instructions, job cards, workplace inspections, and production records in maintaining quality and safety.
4. Describe the methods of waste reduction, material reuse, and safe waste disposal in sustainable apparel manufacturing.
5. Explain the importance of organisational quality standards, workplace reporting, housekeeping, and personal hygiene in ensuring safe and efficient production.

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Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/wn57gucIK5o>

Workplace hazard emergency management



9. Adhere to Industry, Regulatory, and Organisational Standards and Embrace Environmentally Sustainable Practices



Unit 9.1 - Professional Conduct and Workplace Compliance

Unit 9.2 - Legal Compliance and Sustainable Practices

Unit 9.3 - Sustainable Resource and Waste Management



Key Learning Outcomes

By the end of this module, the participants will be able to:

1. Explain the importance of punctuality, attendance, discipline, and ethical conduct in maintaining professional standards in the apparel industry.
2. Outline the importance of workplace punctuality, attendance, and discipline for maintaining productivity and organisational efficiency.
3. Describe organisational policies, customer-specific requirements, legal regulations, and reporting procedures applicable to apparel manufacturing.
4. Elaborate on customer-specific requirements, buyer expectations, and the procedures for communicating with supervisors and authorised personnel to clarify work instructions.
5. Discuss the importance of values, ethics, accountability, and working within the limits of personal responsibility.
6. Highlight the limits of personal responsibility, self-authority, teamwork, supervisor coordination, and organisational escalation procedures.
7. Outline legal, regulatory, environmental, and customer compliance requirements relevant to apparel production and quality management.
8. Outline the procedures for reporting deviations, seeking clarifications, and complying with organisational policies and regulatory requirements.
9. Highlight the importance of green jobs, sustainable workplace practices, and environmental responsibility in the apparel sector.
10. Explain methods for optimising the use of materials, conserving energy, and reducing resource wastage during production.
11. Highlight energy conservation practices, efficient equipment operation, and machine shutdown procedures for promoting a sustainable workplace.
12. Prepare and implement appropriate procedures for the segregation, handling, storage, and disposal of waste materials in accordance with organisational and environmental guidelines.
13. Elaborate on safe and sustainable workplace practices, including switching off equipment when not in use and supporting organisational green initiatives.
14. Elaborate on the role of ethical behaviour, regulatory compliance, and sustainable resource management in improving organisational performance, environmental protection, and customer satisfaction.

UNIT 9.1: Professional Conduct and Workplace Compliance

Unit Objectives

By the end of this unit, the participants will be able to:

1. Explain the importance of punctuality, attendance, discipline, and ethical conduct in maintaining professionalism in the apparel industry.
2. Describe organisational policies, customer requirements, legal regulations, and reporting procedures followed in apparel manufacturing.
3. Discuss the importance of values, ethics, accountability, and working within assigned responsibilities.
4. Outline the procedures for reporting deviations, seeking clarification, and complying with organisational policies and regulatory requirements.
5. Outline the importance of workplace punctuality, attendance, and discipline in maintaining productivity and organisational performance.
6. Elaborate on customer-specific requirements, buyer expectations, and communication with supervisors and authorised personnel to clarify work instructions.
7. Highlight the limits of personal responsibility, self-authority, teamwork, supervisor support, and organisational escalation procedures.

9.1.1 Professional Conduct and Workplace Discipline

Professional conduct and workplace discipline refer to demonstrating ethical behaviour, maintaining professionalism, following organisational rules, and performing assigned duties responsibly in the apparel industry. They promote a safe, productive, and respectful workplace while ensuring compliance with organisational standards and quality requirements.



Fig. 9.1.1: Professional conduct and workplace discipline

The following are the key parameters of professional conduct and workplace discipline:

- **Professional behaviour and ethics**
Employees demonstrate honesty, integrity, respect, professionalism, and ethical conduct while performing their assigned duties.
- **Workplace discipline and responsibility**
Organisational rules, standard operating procedures, and work instructions are followed, and employees remain accountable for their assigned responsibilities.
- **Quality, productivity, and compliance**
Work is completed efficiently while meeting production targets, quality standards, safety procedures, and legal and organisational requirements.
- **Communication and teamwork**
Employees communicate effectively with supervisors and colleagues, cooperate as a team, and report work-related issues through appropriate channels.
- **Continuous learning and improvement**
Employees seek feedback, enhance their skills, and adopt improved work practices to support organisational performance and continuous improvement.

9.1.2 Organisational Policies Legal Requirements

Organisational policies and legal requirements are the rules, procedures, and statutory obligations that guide safe, ethical, and compliant operations in the apparel industry. Adhering to these requirements ensures regulatory compliance, product quality, employee safety, and efficient workplace operations.

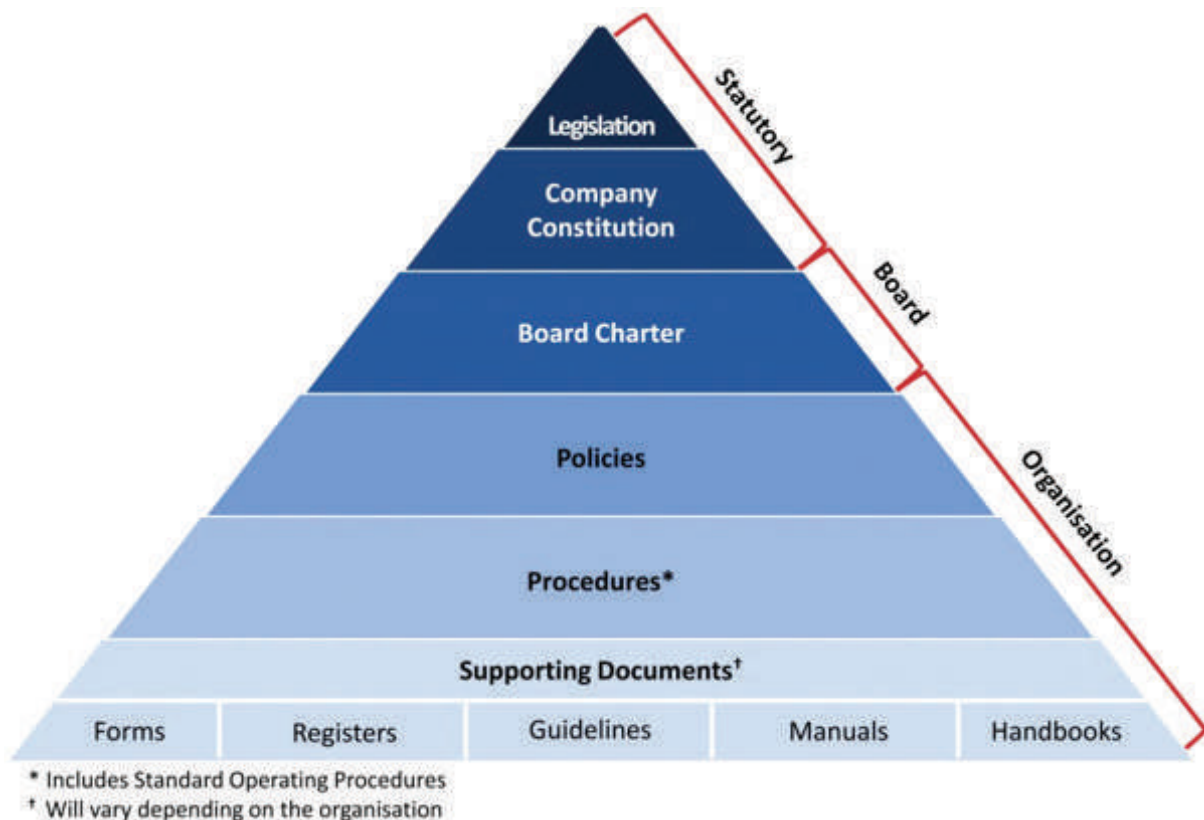


Fig. 9.1.2: Policy and procedure pyramid

The following are the key parameters of organisational policies and legal requirements:

- **Organisational policies**
Employees follow organisational rules, standard operating procedures, and work instructions while performing assigned tasks.
- **Legal and regulatory compliance**
Applicable laws, regulations, and industry standards are followed to ensure safe, ethical, and lawful operations.
- **Customer requirements**
Customer specifications, buyer requirements, and contractual obligations are complied with during production and quality inspection.
- **Workplace safety and quality**
Safety procedures, quality standards, and environmental requirements are followed throughout the manufacturing process.
- **Policy awareness and clarification**
Employees seek clarification from supervisors or authorised personnel whenever policies, procedures, or work instructions are unclear.

9.1.3 Values, Ethics, and Accountability

Values, ethics, and accountability refer to the principles of honesty, integrity, fairness, responsibility, and professional behaviour followed while performing work in the apparel industry. They promote trust, transparency, teamwork, and responsible decision-making across the organisation.



Fig. 9.1.3: Values, ethics, and accountability framework

The following are the key parameters of values, ethics, and accountability:

- **Integrity and honesty**
Employees perform their duties truthfully, fairly, and in accordance with organisational values.
- **Responsibility and accountability**
Employees take ownership of assigned tasks and remain accountable for their work and decisions.
- **Professional ethics**
Confidentiality, impartiality, respect, and ethical behaviour are maintained while interacting with colleagues and customers.
- **Self-authority and escalation**
Employees work within the limits of their authority and report issues requiring higher-level decisions.

- **Teamwork and organisational support**

Employees cooperate with supervisors and team members to achieve organisational goals and maintain workplace discipline.

9.1.4 Deviation Reporting Compliance Procedures

Deviation reporting and compliance procedures involve identifying, reporting, documenting, and correcting deviations from organisational policies, quality standards, legal requirements, or work instructions. They help maintain compliance, prevent recurrence, and support continuous improvement.

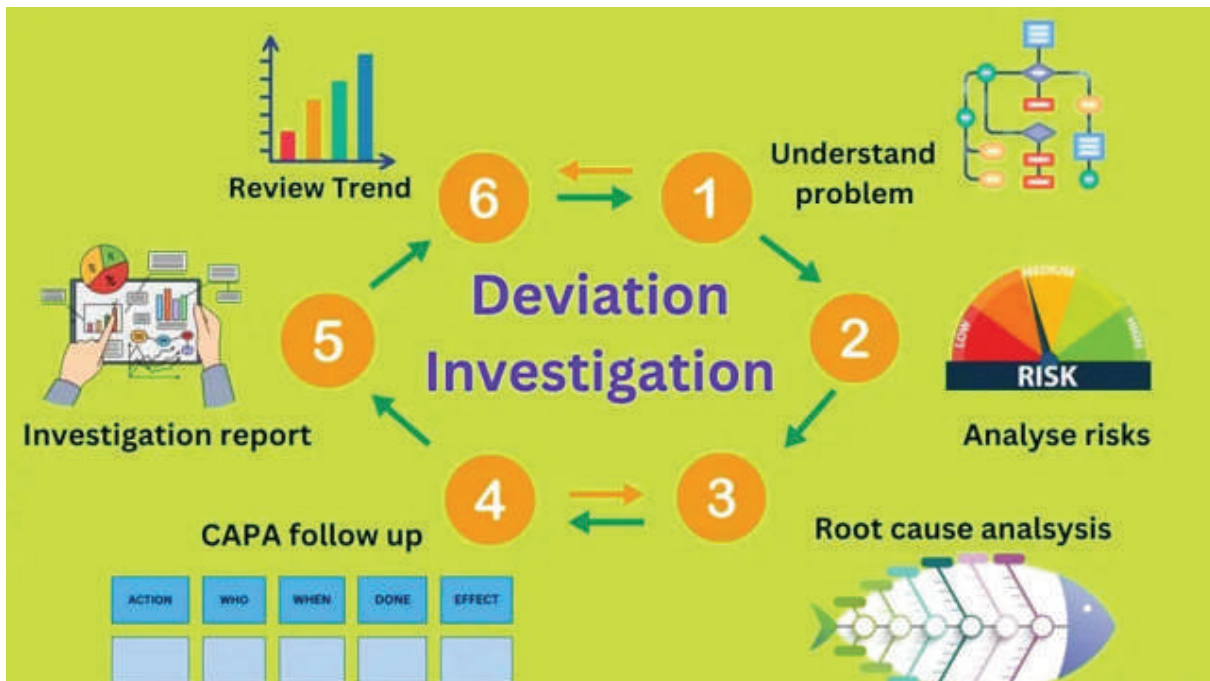


Fig. 9.1.4: Deviation investigation report format

The following are the key parameters of deviation reporting and compliance procedures:

- **Deviation identification**
Quality, safety, process, or regulatory deviations are identified promptly during work activities.
- **Reporting procedures**
Deviations are reported immediately to supervisors or authorised personnel according to organisational procedures.
- **Documentation and records**
Deviation details are accurately recorded using approved reports, forms, and compliance records.
- **Corrective actions**
Appropriate corrective and preventive actions are implemented to eliminate the cause of deviations.
- **Compliance verification**
Completed corrective actions are verified to ensure compliance with organisational, customer, and legal requirements.

9.1.5 Workplace Punctuality and Attendance

Workplace punctuality and attendance refer to reporting for work on time, maintaining regular attendance, and adhering to scheduled working hours in accordance with organisational requirements. They support uninterrupted production, effective teamwork, and improved organisational performance. An ideal log to track these standards is a Daily Shift Attendance and Time-In Sheet, which can be summarised as a structured tracking tool that documents exact arrival times, break durations, and daily attendance to ensure operational continuity, team synchronisation, and strict compliance with organisational hours.

[illegible]

Fig. 9.1.5: Daily shift attendance and time sheet

The following are the key parameters of workplace punctuality and attendance:

- **Timely reporting**
Employees report to the workplace on time and are prepared to begin assigned duties as scheduled.
- **Regular attendance**
Consistent attendance is maintained to support production continuity and operational efficiency.
- **Work schedule compliance**
Working hours, shift timings, breaks, and leave procedures are followed according to organisational policies.

- **Productivity and coordination**

Punctuality and attendance contribute to efficient workflow, teamwork, and timely achievement of production targets.

- **Professional responsibility**

Employees inform supervisors of absences or delays through the prescribed organisational communication procedures.

9.1.6 Customer Requirements and Communication

Customer requirements and communication involve understanding buyer specifications, meeting customer quality standards, and clarifying work instructions to ensure accurate production. The Customer Requirement and Communication Record documents buyer specifications, work instructions, and approvals to ensure production accuracy, traceability, and compliance.

COMPANY NAME AND ADDRESS						
NAME AND TITLE						
TIME OF CALL	FROM/TO	NAME	DURATION OF CALL	CONTACT NUMBER	ACTION TO BE TAKEN	NOTES

Fig. 9.1.6: Customer communication record

The following are the key parameters of customer requirements and communication:

- **Customer-specific requirements**

Customer specifications, technical requirements, and quality expectations are understood before commencing work.

- **Work instruction clarification**

Supervisors or authorised personnel are consulted whenever work instructions, specifications, or procedures are unclear.

- **Buyer expectations**

Products are manufactured and inspected according to buyer requirements, approved samples, and quality standards.

- **Effective communication**

Work-related information, changes, and concerns are communicated accurately through authorised organisational channels.

- **Compliance and documentation**

Customer requirements, approvals, and communication records are documented to maintain traceability and compliance.

9.1.7 Roles, Responsibilities, and Escalation

Roles, responsibilities, and escalation involve performing assigned duties within the limits of personal authority, supporting supervisors and team members, and reporting issues through the prescribed organisational hierarchy. The Roles and Escalation Register documents assigned responsibilities, reporting hierarchy, escalation actions, and supervisory decisions to ensure accountability, timely issue resolution, and compliance.

TEAM OVERVIEW

ROLE DIRECTORY

Name	Reports to	Purpose	KPIs	Tools	Backup

HANDOFFS & DEPENDENCIES

- ---
- ---
- ---

COMMUNICATION PLAN

STAKEHOLDERS

APPROVALS

APPROVALS & VERSIONING

RACI MATRIX

Tasks	Members	R	A	C

COMMUNICATION PLAN

ESCALATION PATH

- ☐ Technical
- ☐ Legal
- ☐ Financial
- ☐ executive
- ☐

MILESTONES

Doc Owner

Fig. 9.1.7: Roles and escalation register

The following are the key parameters of roles, responsibilities, and escalation:

- **Roles and responsibilities**

Employees perform assigned duties according to their job role and organisational responsibilities.

- **Limits of self-authority**

Decisions are made within the scope of authorised responsibilities, and matters beyond authority are escalated appropriately.

- **Supervisor and team support**

Employees cooperate with supervisors and team members to implement organisational policies and achieve work objectives.

- **Escalation procedures**

Operational, quality, safety, or compliance issues are reported promptly through the prescribed reporting hierarchy.

- **Accountability and coordination**

Employees maintain accountability for their work while supporting effective teamwork and organisational coordination.

UNIT 9.2: Legal Compliance and Sustainable Practices

Unit Objectives

By the end of this unit, the participants will be able to:

1. Outline the legal, regulatory, environmental, and customer compliance requirements for apparel production and quality management.
2. Elaborate on how ethical behaviour, regulatory compliance, and sustainable resource management drive organisational performance, environmental protection, and customer satisfaction.

9.2.1 Legal Regulatory Compliance Requirements

Legal and regulatory compliance requirements involve complying with applicable laws, regulations, industry standards, and organisational policies governing apparel manufacturing and quality management. A structured compliance record documents legal requirements, compliance status, inspections, corrective actions, and verification activities to ensure regulatory conformity, product quality, and safe operations. The following are the key parameters of legal regulatory compliance requirements:

Compliance aspect	Description
Legal compliance	Applicable laws, regulations, and statutory requirements are followed during all work activities.
Organisational compliance	Organisational policies, standard operating procedures, and work instructions are implemented consistently.
Customer and industry standards	Customer specifications, quality standards, and industry requirements are complied with throughout production.
Regulatory reporting	Legal or regulatory deviations are reported promptly according to organisational procedures.
Compliance verification	Compliance activities are monitored, documented, and verified to maintain regulatory conformity.

Table 9.2.1: Legal regulatory compliance requirements

9.2.2 Ethical Compliance Sustainable Resource Management

Ethical compliance and sustainable resource management involve performing work with integrity while using materials, energy, water, and other resources responsibly to minimise environmental impact. A structured sustainability record documents resource consumption, conservation measures, ethical compliance, and improvement actions to support resource efficiency, environmental responsibility, and regulatory compliance. The following are the key parameters of ethical compliance and sustainable resource management:

Management aspect	Description
Ethical compliance	Employees perform their duties with honesty, integrity, fairness, and accountability.
Responsible resource utilisation	Materials, energy, water, and workplace resources are used efficiently to minimise wastage.
Environmental responsibility	Sustainable work practices are followed to reduce pollution, conserve resources, and protect the environment.
Organisational sustainability practices	Greening solutions, environmental policies, and sustainability procedures are implemented during work activities.
Continuous resource improvement	Resource utilisation is monitored and improved through conservation practices and continuous improvement initiatives.

Table 9.2.2: Ethical sustainable resource management

UNIT 9.3: Sustainable Resource and Waste Management

Unit Objectives

By the end of this unit, the participants will be able to:

1. Highlight the importance of green jobs, sustainable work practices, and environmental responsibility in the apparel industry.
2. Explain methods for optimising material usage, conserving energy, and minimising resource wastage during production.
3. Prepare procedures for the segregation, handling, storage, and disposal of waste in accordance with organisational and environmental guidelines.
4. Elaborate on safe and sustainable workplace practices, including switching off equipment when not in use and supporting organisational green initiatives.
5. Highlight energy conservation practices, efficient equipment operation, and the importance of switching off machines when not in use to promote a sustainable workplace.

9.3.1 Green Jobs Sustainable Workplace Practices

Green jobs and sustainable workplace practices involve performing work in ways that conserve natural resources, reduce environmental impact, and support sustainable development in the apparel industry. They promote responsible resource use, waste reduction, energy efficiency, environmental compliance, and long-term organisational sustainability.

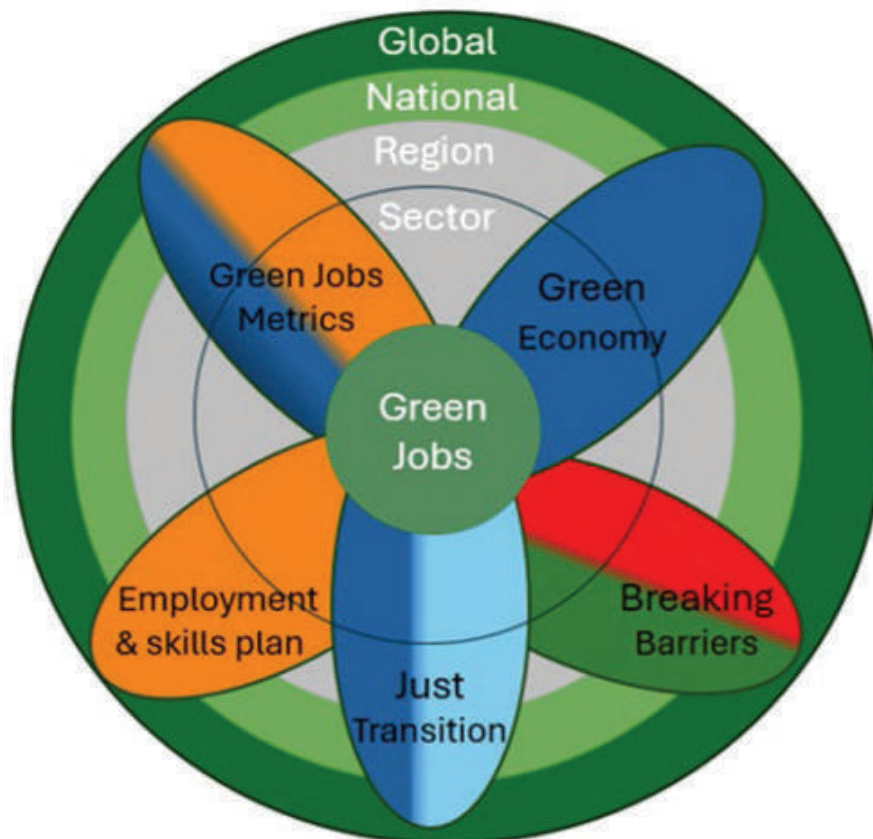


Fig. 9.3.1: Green job and sustainability components in workplace

The following are the different types of green jobs and sustainable workplace practices in the apparel industry that an apparel quality analyst must be well aware of:

Green job type	Green job role	Sustainable workplace practices	Example
Sustainable quality management	Ensures garment quality while reducing defects, rework, and material wastage.	Conduct first-time-right inspections, prevent defects, maintain quality records, and improve processes.	Quality Control Orders (QCOs) under the BIS Act, 2016.
Sustainable manufacturing	Improves production efficiency while reducing resource use and waste.	Optimise production, minimise fabric wastage, improve machine efficiency, and reduce rework.	SAMARTH (Scheme for Capacity Building in Textiles).
Resource and energy management	Conserves energy, water, and other production resources.	Switch off idle machines, use energy-efficient equipment, conserve water, and monitor resource use.	Perform, Achieve and Trade (PAT) Scheme of the Bureau of Energy Efficiency (BEE).
Waste and recycling management	Reduces production waste through segregation, reuse, and recycling.	Segregate waste, reuse fabric remnants, recycle materials, and follow approved disposal methods.	Solid Waste Management Rules, 2016.
Environmental compliance management	Ensures compliance with environmental laws and pollution control requirements.	Prevent pollution, handle chemicals safely, control emissions, and maintain compliance records.	Environment (Protection) Act, 1986.
Sustainable supply chain management	Promotes responsible sourcing and supply chain traceability.	Source sustainable materials, verify supplier compliance, reduce packaging waste, and maintain traceability.	National Technical Textiles Mission (NTTM).

Table 9.3.1: Green jobs and sustainable apparel workplace practices overview

9.3.2 Material Energy Resource Optimisation

Material, energy, and resource optimisation involve using raw materials, utilities, and production resources efficiently to minimise waste and improve productivity in the apparel industry through an MRP checklist:

[illegible]

Fig. 9.3.2: MRP checklist

On the same note as above, an optimised energy management system reduces production costs, conserves natural resources, improves operational efficiency, and supports sustainable manufacturing.



Fig. 9.3.3: Optimised energy management system benefits

The following are the key methods of material, energy, and resource optimisation in the apparel industry:

Optimisation method	Purpose	Optimisation practices	Example
Material optimisation	Reduces fabric and trim wastage.	Optimise marker planning, minimise cutting waste, and reuse usable remnants.	Fabric marker optimisation software.
Energy optimisation	Reduces electricity and fuel consumption.	Switch off idle machines, use energy-efficient equipment, and monitor energy use.	PAT Scheme of the Bureau of Energy Efficiency (BEE).
Water optimisation	Conserves water during production.	Prevent leaks, recycle water where applicable, and minimise unnecessary usage.	Water conservation initiatives under textile processing units.
Equipment optimisation	Improves equipment efficiency and productivity.	Perform preventive maintenance and operate machines according to manufacturer guidelines.	Preventive maintenance schedules.
Resource monitoring	Tracks resource consumption and wastage.	Maintain resource records and analyse consumption trends.	Energy and material consumption registers.

Table 9.3.2: Material energy resource optimisation methods

9.3.3 Waste Segregation Handling Disposal Procedures

Waste segregation, handling, and disposal procedures involve identifying, separating, storing, transporting, and disposing of different waste streams according to organisational and environmental requirements. Proper waste management reduces pollution, improves workplace safety, supports recycling, and ensures environmental compliance.



Fig. 9.3.4: Waste segregation bins for safe waste handling

The following are the key waste segregation, handling, and disposal procedures in the apparel industry:

Waste category	Handling procedure	Disposal procedure	Example
Fabric waste	Segregate by material type and store separately.	Reuse or recycle through authorised recyclers.	Cotton fabric off-cuts.
Paper and packaging waste	Collect in designated bins and keep dry.	Send for paper or cardboard recycling.	Cartons and paper rolls.
Plastic waste	Separate clean plastic materials from other waste.	Recycle through authorised recycling agencies.	Polybags and plastic packaging.
Chemical waste	Store in labelled containers using safety procedures.	Dispose of through authorised hazardous waste handlers.	Solvents and chemical containers.
Electronic waste	Collect separately without damage or dismantling.	Dispose through authorised e-waste recyclers.	Electrical components and electronic devices.

Table 9.3.3: Waste segregation handling disposal procedures

9.3.4 Safe Sustainable Workplace Practices

Safe and sustainable workplace practices involve performing work safely while minimising environmental impact through responsible use of materials, equipment, and workplace resources. They improve employee safety, environmental protection, operational efficiency, and regulatory compliance.



Fig. 9.3.5: Workplace sustainability practices

The following are the key safe and sustainable workplace practices in the apparel industry:

Workplace practice	Purpose	Safe and sustainable practices	Example
Safe machine operation	Prevents accidents and equipment damage.	Operate machines safely and follow standard operating procedures.	Sewing and cutting machine operation.
Resource conservation	Reduces unnecessary resource consumption.	Use materials, water, and energy efficiently.	Controlled fabric utilisation.
Pollution prevention	Minimises environmental impact.	Prevent spills, control emissions, and manage waste properly.	Chemical handling procedures.
Workplace housekeeping	Maintains a clean and safe workplace.	Remove obstructions, clean work areas, and organise materials.	Daily housekeeping checklist.
Regulatory compliance	Ensures legal and organisational compliance.	Follow safety, environmental, and quality requirements.	OSH Code, 2020 workplace practices.
Workplace practice	Purpose	Safe and sustainable practices	Example

Table 9.3.4: Safe, sustainable workplace practices

9.3.5 Energy Conservation Practices

Energy conservation practices involve reducing energy consumption through efficient operation of machinery, equipment, lighting, and utilities during apparel manufacturing. They lower operating costs, reduce environmental impact, and improve organisational sustainability.



Fig. 9.3.6: Workplace energy conservation stages

The four Ps of energy conservation are to prevent energy wastage, plan efficient resource use, perform energy-efficient operations, and promote continuous energy-saving practices across the workplace, in accordance with an energy conservation pyramid. The energy conservation pyramid is a hierarchy that prioritises reducing energy demand first, improving energy efficiency second, and using renewable energy last to achieve sustainable workplace energy management.

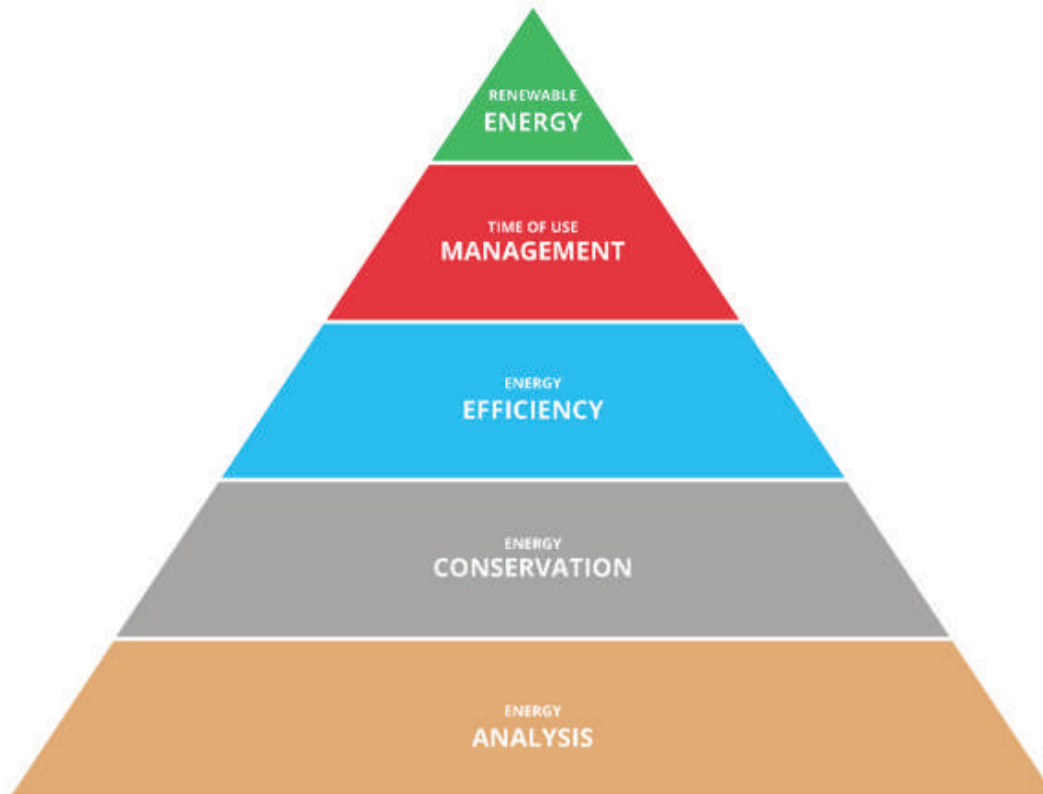


Fig. 9.3.7: Energy conservation pyramid

The following are the key energy conservation practices in the apparel industry:

Energy conservation practice	Purpose	Conservation practices	Example
Machine shutdown	Eliminates unnecessary energy consumption.	Switch off machines when not in use.	The sewing machine shut down after work.
Efficient equipment operation	Improves equipment performance with lower energy use.	Operate machines according to recommended settings.	Energy-efficient sewing machines.
Lighting management	Reduces electricity consumption.	Switch off unnecessary lights and maximise natural lighting.	LED lighting systems.
Preventive maintenance	Maintains equipment efficiency.	Inspect and maintain machines regularly.	Preventive maintenance programme.

Energy conservation practice	Purpose	Conservation practices	Example
Energy monitoring	Tracks and controls energy consumption.	Record energy usage and implement improvement measures.	Energy consumption monitoring register.
Energy conservation practice	Purpose	Conservation practices	Example

Table 9.3.5: Energy conservation workplace practices

Summary



- Punctuality, attendance, discipline, and ethical conduct are essential for maintaining professionalism in the apparel industry.
- Organisational policies, customer requirements, legal regulations, and reporting procedures guide safe and compliant apparel manufacturing.
- Values, ethics, accountability, and personal responsibility promote responsible workplace behaviour.
- Legal, regulatory, environmental, and customer compliance requirements ensure quality and regulatory conformity.
- Deviations from procedures should be reported promptly and handled according to organisational policies.
- Green jobs, sustainable workplace practices, and environmental responsibility support sustainable industrial development.
- Efficient use of materials, energy conservation, and resource optimisation reduces production costs and environmental impact.
- Proper segregation, handling, storage, and disposal of waste support environmental protection and regulatory compliance.
- Safe and sustainable workplace practices, including responsible equipment use, improve workplace efficiency and safety.
- Ethical behaviour and regulatory compliance strengthen organisational performance and customer confidence.
- Sustainable resource management helps protect the environment while improving operational efficiency.
- Following professional ethics, regulatory standards, and sustainable practices enhances product quality, productivity, and customer satisfaction.

Exercise

Multiple-choice Question:

1. Why are punctuality and discipline important in the apparel industry?
 - a. To increase paperwork
 - b. To maintain professional standards
 - c. To reduce production quality
 - d. To increase production costs

2. Why should organisational policies and legal regulations be followed?
 - a. To ensure compliance and quality production
 - b. To reduce employee attendance
 - c. To increase waste generation
 - d. To avoid quality inspections

3. What is the purpose of waste segregation in apparel manufacturing?
 - a. To increase production waste
 - b. To support safe disposal and environmental protection
 - c. To reduce product quality
 - d. To increase storage costs

4. Which practice helps conserve resources during production?
 - a. Excess material usage
 - b. Energy conservation and material optimisation
 - c. Improper waste disposal
 - d. Continuous machine operation when idle

5. How do ethical behaviour and regulatory compliance benefit an organisation?
 - a. By increasing defects
 - b. By improving organisational performance and customer satisfaction
 - c. By reducing accountability
 - d. By increasing production delays

Descriptive Questions:

1. Explain the importance of professional ethics, discipline, and organisational policies in the apparel industry.
2. Describe the role of legal, regulatory, environmental, and customer compliance in apparel manufacturing.
3. Explain methods for conserving materials, saving energy, and managing waste during production.
4. Describe the procedures for waste segregation, handling, storage, and disposal.
5. Explain how ethical behaviour, regulatory compliance, and sustainable workplace practices improve organisational performance and environmental protection.

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Scan the QR codes or click on the link to watch the related videos



<https://youtu.be/O1qTFFF0zd8>

Waste segregation, handling, and disposal procedures



<https://youtu.be/O1qTFFF0zd8>

Waste segregation, handling, and disposal procedures



10. Employability Skills



Employability Skills is available at the following location



<https://www.skillindiadigital.gov.in/content/list>

Employability Skills

11. Annexure



Module No.	Unit No.	Topic Name	Page No	Link for QR Code (s)	QR code (s)
Module 1: Introduction and Orientation to Apparel Quality Analyst	Unit 1.1 Apparel Quality Analyst Profession Insights	1.1.1 Apparel Industry Size and Scope	19	https://youtu.be/5dLX8mRAE88	 Apparel industry in India
Module 2: Analyse and Classify Garment Defects in Apparel Production	Unit 2.1 Garment Defects and Quality Evaluation	2.1.1 Garment Defect Management	54	https://youtu.be/WTIFD2MQdbM	 Garment and fabric defects
Module 3: Analyse Data and Prepare Quality Insights Reports	Unit 3.1 Production Quality Control Processes	3.1.1 Production Quality Monitoring	87	https://youtu.be/MR0qAxYeqfY	 QA in garment production for production quality
	Unit 3.2 Quality Documentation and Records	3.2.3 Control Chart Analysis	87	https://youtu.be/_675toMA4gA	 Understanding control chart analysis
Module 4: Integrate Digital and AI Tools in Quality Assurance Systems	Unit 4.1: AI Quality Systems Fundamentals	4.1.1 Digital AI Tools in Quality Assurance	107	https://youtu.be/0ZuHnJkAZiQ	 AI usage in apparel industry

Module No.	Unit No.	Topic Name	Page No	Link for QR Code (s)	QR code (s)
Module 5: Utilise AI-Based Analytics for Quality Monitoring	Unit 5.1: AI-Powered Quality Analysis and Improvement	5.1.3 AI-Generated Quality Data Analysis	123	https://youtu.be/-O5aqZ55QR8	 AI-generated quality data analysis
Module 6: Apply Quality Control Tools and Techniques	Unit 6.2: Quality Improvement Documentation Practices	6.2.3 Corrective Preventive Action Planning	147	https://youtu.be/RfCkKcVuBfg	 Corrective preventive action planning (CAPA)
Module 7: Document, Report, and Visualise Quality Data	Unit 7.1: Documentation Reporting	7.1.2 Production Data Recording Systems	168	https://youtu.be/Fp22WTke_iE	 Production data recording systems (Excel)
Module 8: Promote and Sustain Safety, Health, and Security in Workplace, while Fostering Gender and Persons with Disabilities (PwD) Sensitisation	Unit 8.1: Workplace Safety and Compliance	8.1.3 Workplace Hazard Emergency Management	229	https://youtu.be/wn57gucIK5o	 Workplace hazard emergency management

Module No.	Unit No.	Topic Name	Page No	Link for QR Code (s)	QR code (s)
Module 9: Adhere to Industry, Regulatory, and Organizational Standards And Embrace Environmentally Sustainable Practices	Unit 9.3: Sustainable Resource and Waste Management	9.3.3 Waste Segregation Handling Disposal Procedures	254	https://youtu.be/O1qTFFF0zd8	 Waste segregation, handling, and disposal procedures





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**APPAREL MADE-UPS HOME FURNISHING
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