Application Quality Methods in Garment Production

Source: New Cloth Market

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Dr Gordana Colovic and Dr Danijela Paunovic
The College of Textile – Design, Technology and Management, Belgrade, Serbia
(Emails : gordanacolovic@gmail.com, vspaunovic@gmail.com)

Abstract: *Fast changes in technology as well as customers' expectations make a producer keeping improving fashion products and quality in order to keep position on the market. Fashion industry need to reduce response time, eliminate errors, and improve customer satisfaction. This paper presents possibility of application FMEA method and Method 7 step in garment industry.*

Keywords: *quality, FMEA method, Method 7 steps, denim trousers*

INTRODUCTION

The textile industry is a very important branch of the Serbian economy, not only because it is consitsted of a large number of companies and employees, whereas it has a large stake in the exports. Serbia exports about 78% of its clothing products to 6 European countries (Italy, Germany, Bosnia and Herzegovina, Slovenia, France and Montenegro) and imports about 73% clothing products from China, Turkey, Slovenia, Germany and India. In 2007 there were 1489 registered textile companies, mostly SMEs.

Industrial way of production needs a thorough preparation of manufacturing because, simultaneously, it is necessary to combine several factors: people, time, machines and place of production, organization and material in a coordinated and rational system. Technological system of garment production must provide the quality of the product that is expected, necessary scope of production, and delivery of ready-made garments in the expected time, maximal use of capacities with minimal expenses.

Total Quality Management (TQM) is defined as an approach to quality management in PBS, based on participation of all employees, focused on long-term success by meeting the needs of consumers. TQM is a way to improve the functioning of the PBS continually, on all its levels and using all available resources.

Methods of quality can be divided into three groups :

1. Basic tools of quality - Histogram, Scatter diagram, Correlation diagram, ABC-Pareto diagrams, Ishikawa diagrams and Control Charts.
2. Complementary tools of quality - Flowcharts, Nominal group technique, A guide for organizing meetings, Affinity Diagram, Fault tree diagrams, *Matrix Diagram,* PDPC (Process Decision Program Chart) diagram.
3. Methods and techniques of quality - brainwriting and brainstorming, SWOT analysis, FTA analysis (Fault Tree *Analysis),* Value analysis, Network diagram, Kanban, Rolling, Poka-yoke, Zero defect, FMEA method, QFD method and Method 7 steps. [1]

The importance of quality methods in the manufacture of garment is presented through the analysis of the denim garment manufacturers. We used two methods: FMEA method and Method 7 step.

FMEA

FMEA (Failure Mode and Effect Analysis) is a method to identify potential errors before they occur. The basic parameters by which this method is recognized relate to three key elements in the application of FMEA methods :

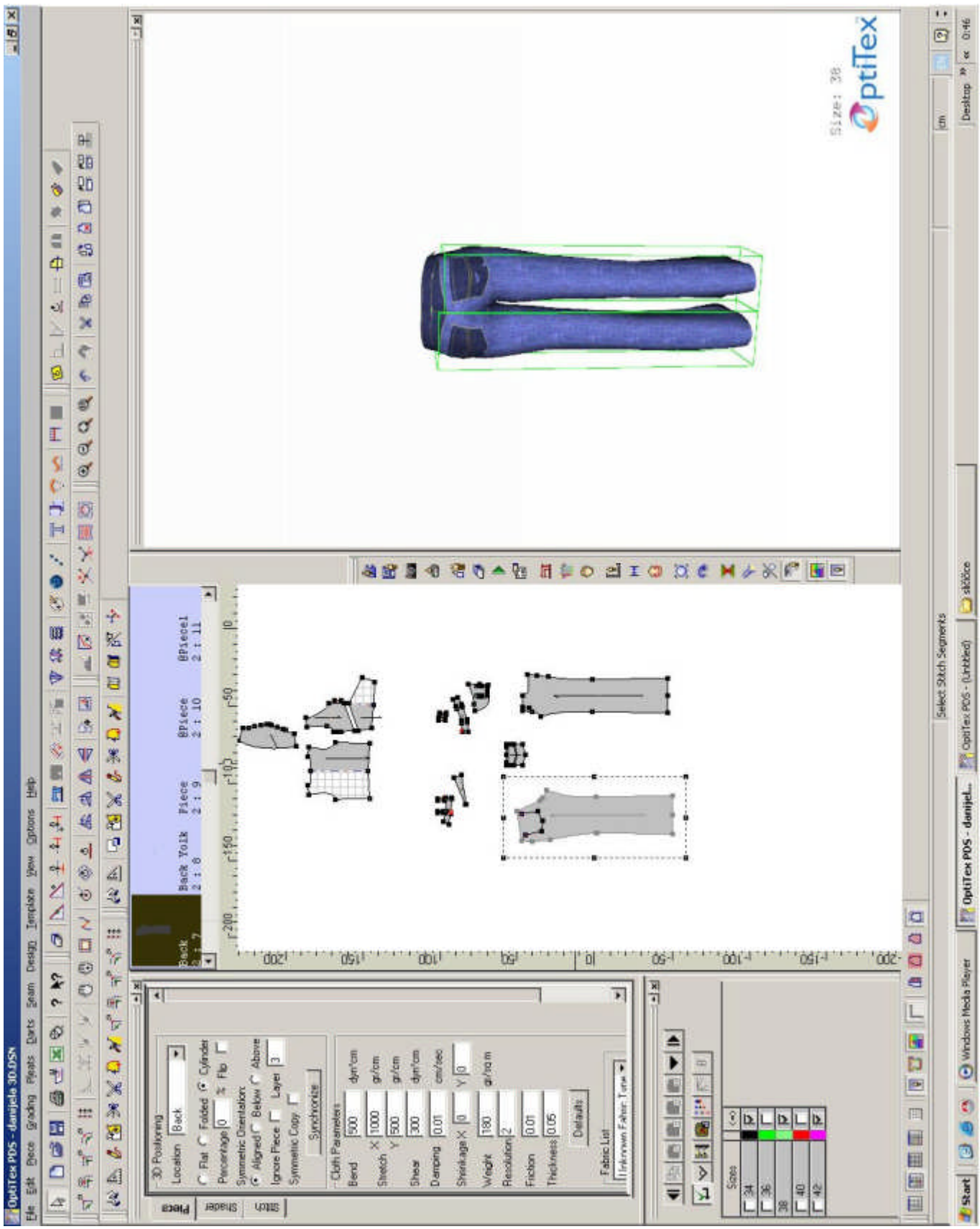
- The importance of consequences.
- Probability of occurrence.
- Probability of detection error.

Application of FMEA methods in risk management in production-business systems refers to the initial phase of definition and prediction of all possible risk factors and calculated risk priority.

Some these risks can be grouped by type of errors that occur to their implementation. For effective risk assessment and implement measures to reduce their need to conduct FMEA on the team whose members have a basic knowledge of generating ideas [2].

Application Quality Methods In Garment Production

Figure 1 : Denim Trousers



Application Quality Methods In Garment Production

If we look at quality as the degree of satisfaction with what we produce, we offer, provide or sell, having a tendency to circle these users are increasingly expanding, it is necessary to define the limitations that are present in the creation of quality.

The concept of quality in a broad sense, including other groups of users that certain actions in society should be met in order to create quality for the customer could be realized.

Risks to quality garment products or other products, they are all risks in any way hinder or completely eliminate the possibility of the formation and increase quality. Risks exist in every segment, be it on the project, managing the production process or providing services.

Quality Risk Management have rules by which include measures, methods and tools to identify risks of quality, rank, process, control, restrict or diminish and the preventive effect on preventing their occurrence.

For example, the production of high quality garment products is necessary to foresee all possible risks that can lead to reduced security when wearing garment products such as buttons falling off, damaged seams or pockets, ripping, tearing interlining, etc.

By identifying these risks, assess and analyze the behavior of garment products to wear, with the final outcome depends on the ability of producers in the perception of possible consequences and adjustment of performance products.

The activities that analyze the risks, it is necessary to take into account the fact that complete protection against the risk is almost never possible. Manufacturer can influence the customer's way of wearing garment and care products.

Customer is not interested in most of

Figure 2 : FMEA Document

Function	Potential Failure Mode	Potential Effects(s) of Failure	S	Potential Cause(s) of Failure	O	Current Process Controls	D	RPN	CRIT	Recommended Action(s)	Responsibility and Target Completion Date	Action Results: Action Taken	Action Results: S	Action Results: O	Action Results: D	Action Results: RPN	Action Results: CRIT
Dispense amount of cash requested by customer	Does not dispense cash	Customer very dissatisfied	8	Out of cash	5	Internal low-cash alert	5	200	**40**								
				Machine jams	3	Internal jam alert	10	240	24								
		Incorrect entry to demand deposit system		Power failure during transaction	2	None	10	160	16								
		Discrepancy in cash balancing															
	Dispenses too much cash	Bank loses money	6	Bills stuck together	2	Loading procedure (riffle ends of stack)	7	84	12								
		Discrepancy in cash balancing		Denominations in wrong trays	3	Two-person visual verification	4	72	18								
	Takes too long to dispense cash	Customer somewhat annoyed	3	Heavy computer network traffic	7	None	10	210	21								
				Power interruption during transaction	2	None	10	60	6								

Application Quality Methods In Garment Production

the methods by which the total risk that is faced reduced to an acceptable level. The customer will purchase the product or accept payment for the overall risk quality in that product or service installed.

The objectives of the application of FMEA in risk management methods are reflected in preventive activities that would not have made mistakes and developing appropriate methods of solution if the error, regardless of the measures taken, actually occurs. While these targets are identified as SMART goals (Specific, Measurable, Achievable, Related to the customer, Time targeted). [7]

The objectives of FMEA method, by definition, fall into SMART targets for several reasons, like as folowing :

* clear and unambiguous objectives provide the application of FMEA method is the key to success,

* measurable goals read into the pre-defined risk factor priorities we want to achieve,

* the basic goal of FMEA is reducing the possibility of error is achieved at the moment when they identified all possible risks and define actions to reduce these risks,

* FMEA method is oriented towards the customer, as the quality of the product increases its pleasure (the average reasonable costumer between the two products of the same utility properties and same price always will choose the at which one observes a higher level of quality),

* application of FMEA method is time-limited and is being implemented in the given time.

The goal of implementing FMEA methods not only identify all the causes of potential risks and their consequences elsewhere, but this

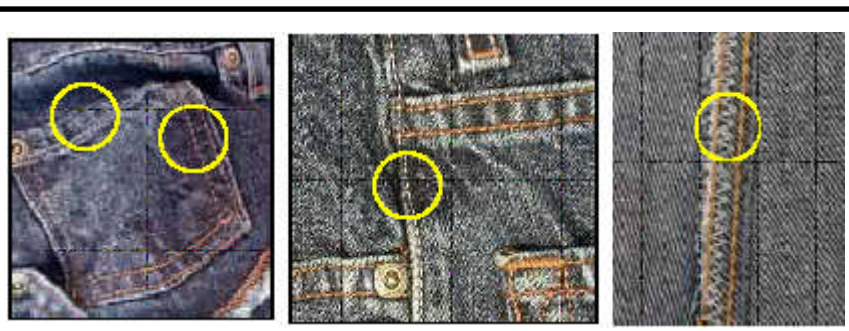


Figure 3 : Finding the possible consequences error

method would have to create a useful base for menagers and answer the basic question: whether to apply a set of preventive measures and reduce the risk of fulfillment or completely ignore specific risk groups as irrelevant to the production-business systems operations and further development. [3]

APPLICATION OF FMEA

On the example of designing and manufacturing of denim trousers and tracking the given product after the period of exploitation, 15 basic steps were applied:

1. Decision of the management to apply FMEA method (due to buyers' claims, because FMEA method is, by its nature oriented towards the product buyer).

2. Denim trousers analysis and description of model.

3. Fabrication of FMEA application.

4. Finding possible consequences of each separate error – esthetic and functional characteristics of trousers are disturbed because of occurrence of assumed errors.

5. Estimate of importance of consequence of error – because of occurrence of such errors in fashion product number of claims increases and gradually position of the denim clothes producer on market is lost.

6. Gathering ideas of all potential errors that may arise – model of denim trousers are photographed and places of possible errors are marked.

7. Finding all possible causes of error occurrence – for each possible error it is necessary to analyze the cause specifically by Ishikawa diagram (Cause and Effect diagrams), which takes into consideration cause and effect influences of man-machine-material-method.

8. Estimate of probability of discovery of error – racking of manufacturing of denim trousers through all phases of manufacturing and every technological operation till finishing processing and packing, in order to increase percentage of discovery of errors while they can still be eliminated.

9. Estimate of probability of error occurrence – according to statistic analysis of most common errors, in finished garment 75 % originate in construction preparation of production, namely :

- Cutting parts do not fit the model.
- Bad positioning of cutting parts.
- Unsigned indentation.
- Lack of cutting part.
- No percent for stretching.
- Deviations in grading.
- Bad cut.
- No grading all cutting parts.
- Large consumption of materials.
- Missing cutting part in cutting layout.
- Inadequate size of cutting layout.

Application Quality Methods In Garment Production

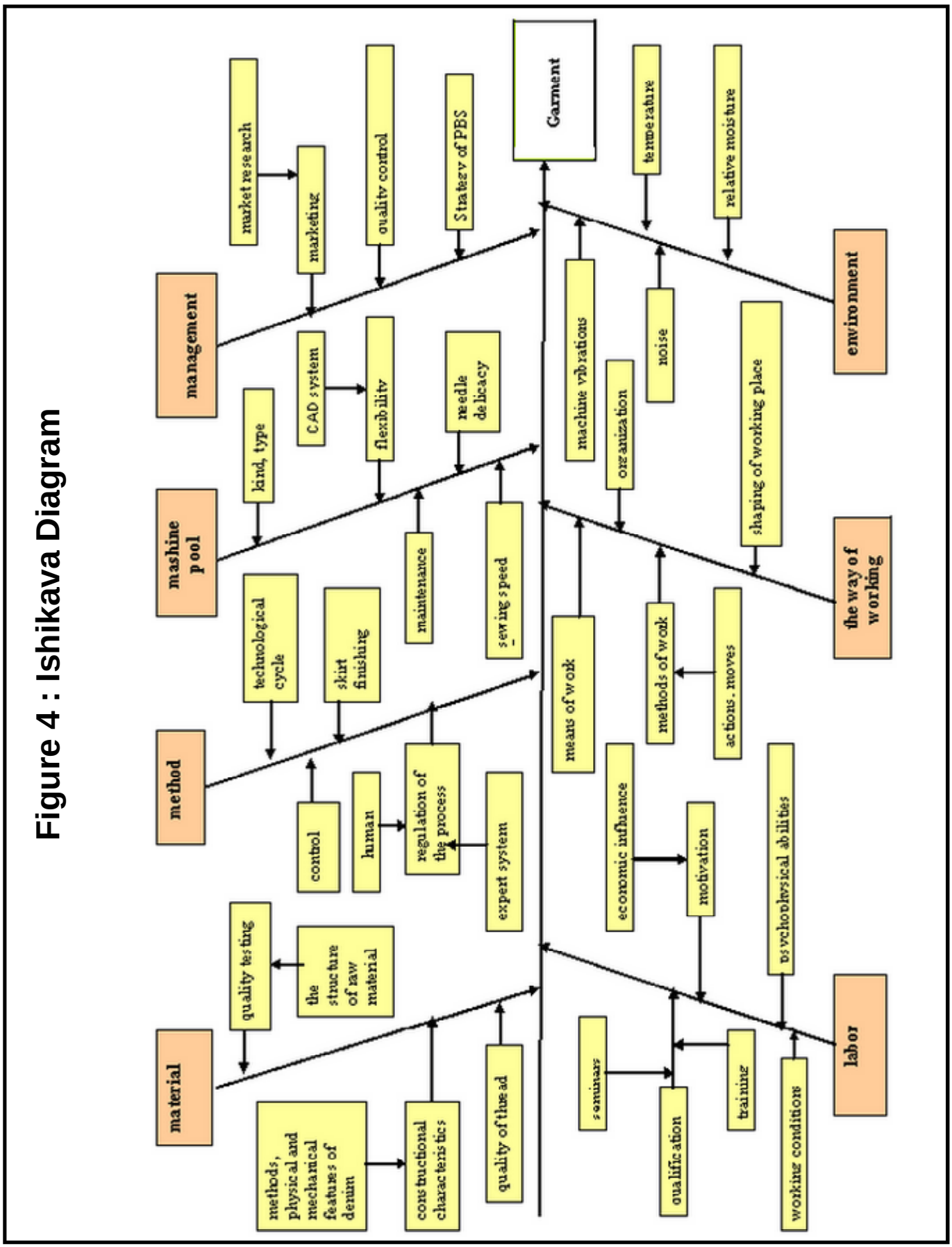


Figure 4 : Ishikava Diagram

Application Quality Methods In Garment Production

Unique manufacturing of denim garment article demands from the producer also the application of appropriate standard for seams (specific density of denim and percentage of elasticity of the material) and type stitches, etc.

10. Making an inventory of existing controls – it has been established that besides finished quality control (when only an error is stated) quality control between phases is partially performed during cutting out and forming of bundles for production. Workers leave responsibility for the quality of manufacturing to the foreman and do not control technological operation that has been done on a previous machine, nor do they fix or point to their mistakes.

11. Calculation of RPN factor for every consequence – it is necessary to establish priority risk factor i.e.: risks that can be influenced, risks that can not possibly be influenced, visible risks, hidden risks, risks that cause consequences, risks that have no consequences, external risks (risks coming out of the environment), internal risks (internal risks in production-business systems) and specific risks.

12. Ranking of potential errors by priority – it is necessary to establish which errors influence quality of finished fashion product and esthetic appearance for the most part, because denim skirt is in accordance with the present fashion trend.

13. Suggestion and undertaking measures that eliminate or reduce the risk of error occurrence – introduction of quality system, application of ISO sizes standard, ISO for stitches and types of seams, training of workers and team responsibility.

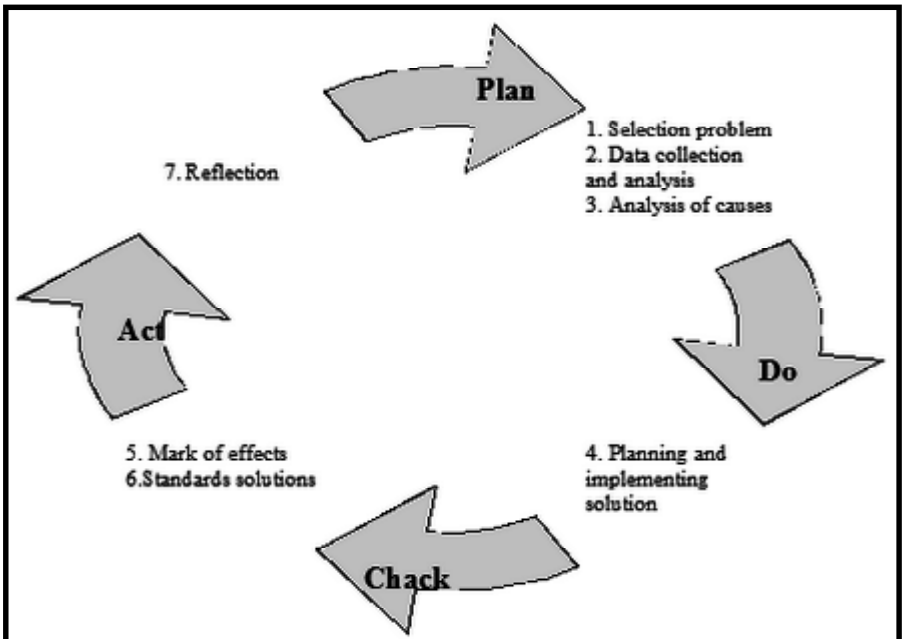


Figure 5 : Method 7 step

14. Calculation of RPN factor.

15. Production-business systems management report. [4]

METHOD 7 STEPS

Method 7 step is supported by the PDCA (Plan-Do-Chack-Act) cycle, and provides answers to questions: What to do to improve the quality?

Continuous repetition of seven steps within the PDCA cycle developed many habits :

- Understanding of the problem.
- Training and promotion.
- Teamwork.
- Diagnostic process. [1]

APPLICATION METHOD 7 STEPS

Step 1: Selection problem

To competed a fashion product for the market need to minimize errors. The most common errors on denim trousers are (Figure 6) :

- Unevenly sewn b**elt loops**.
- Button-holes and button not properly positioned.
- Band after finishing does not match the original dimension.

Step 2: Collect and analyze data

This step is the basis for exploring the causes of the problem. Therefore, we use quality tools such as: Histograms, Pareto diagrams, Scatter diagrams and Line diagrams.

Of 450 products surveyed the number of errors was 103, or it can be concluded that one in four products does not match the requirements of quality (Figure 7). Mistakes are not negligible.

Step 3: Analysis of causes

All causes of problems and errors can best perceive the application of Ishikawa diagram. Its application is enabled to :

1. Specify the basic questions and to pick the main factors of quality, and

Application Quality Methods In Garment Production

make their analysis and demonstrate a cause-effect relationships.

2. Facilitate resolution of problems, ranging from determining the symptoms, through due until finding a final solution.

Over Ishikawa diagram shown on Figure 4 it was considered seven factors that directly affect the quality of the denim jeans :

Management : Strategy production-business systems on the basis of organized marketing team must be clearly defined, systematically planned and oriented with the continuous application of TQM.

Material : Examine the physical and mechanical properties denim, raw materials, constructional parameters of fabrics and match with the quality of supporting material (thread, buttons ....).

Man : It is necessary to continuously train employees in accordance with the purchase of new equipment and technology in an ergonomically acceptable work conditions, adequate pay and motivate them.

Figure 6 : Errors on denim trousers

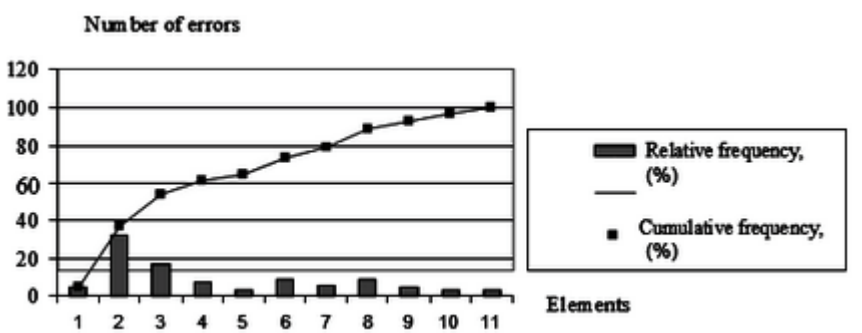


Fig 7 : Pareto diagram for the analysis of detected errors (frequency)

The environment : The optimal working conditions especially in the garment industry, temperature, noise, humidity and vibration are factors that should be kept at the lowest possible level.

Methods : The introduction of modern computer technology and using a database of expert systems and methods of control are optimized, the whole technological cycle adjusts the parameters of a new product. Errors on trousers in finishing phases and versatile control trials can be removed.

Mode : Training and training methods are applied for each workplace, work resources to modernize and harmonize existing workplace with the organization and layout of machinery.

Machine : The frequent changes in fashion trends and changes in the types of products, and the main articles has to be flexible (with the use of CAD systems), it is easy to maintain. For quality products sewing speed, the types of needles and maintain sewing machines must be good.

Step 4 : Planning and implementation of solutions

Deformation seams and errors is possible to predict the experimental samples (sample size 5x20 cm) of any changes in the characteristics of textile materials, threads and the types of sewing machines using a different type of weld (ISO 4915 and ISO 4916).

Planning and implementation of solutions found errors that can be based on previous analysis to predict should be planned for each material and garment.

Step 5: Assessment of the effects

Application of modern CAD systems for design and construction garment to the adoption of models and production planning with all the parameters that influence on the final shape cutting parts and garment. Virtual pattern, sewing materials and simulations in a modern, fast and

Application Quality Methods In Garment Production

economical way is a step towards improving the quality and allows the most sophisticated design.

Step 6: Standardization of solutions

Standardization size, parts of patterns and the process of inevitable for success in the market.

Step 7 : Reflection

Reflection on the process is identified to answer the question whether the problems are resolved, whether the results apply, the next part of the technological process should be improved and if workers accept the method.

If the suggestions of previous analysis does not apply or only apply for one phase of work, the whole process will in part be successful in the short term.

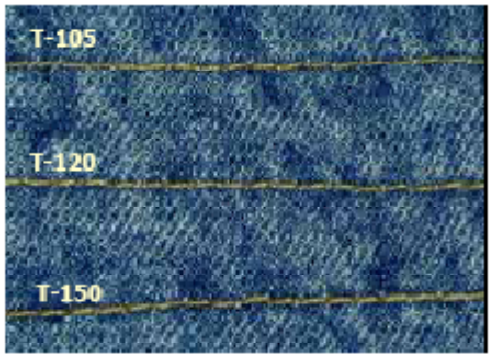


Figure 8 : Experimental samples (different fineness thread)

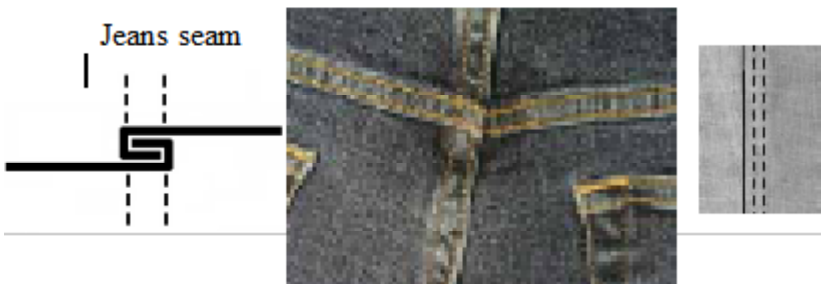


Figure 9 : Effect of the seam on the garment

CONCLUSION

Complex analysis and acceptance of the team standpoints, which analyzes the real buyer of the garment product, brings production-business systems staff in garment industry to think about which methods to use which enable identification of the quality product that will have the real place on the market. Quality methods used to enhance the effectiveness, efficiency, flexibility and competitiveness.

In this paper we analysis FMEA method and Method 7 step. After analysis was nessesery to :

- Introduced the intermediate quality control in every aspect of design preparation in the classical way and the computer system.
- Control of technological operations on the previous machine made by workers.
- Monitoring the development of denim trousers through all stages of development and each operation until final processing and packaging, to increase the % detection of errors.
- Determining the priority risk factors.
- Ranked the potential error rate prioriteu.
- Envisages the introduction of quality systems, application of standards, training staff and team responsibility.

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Application Quality Methods In Garment Production

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Time is a dressmaker specializing in alterations.

- Faith Baldwin

Figure 9 : Simulation of denim jeans

Quality Checking

The quality department maintains the quality standards from stores, sampling, cutting, production, finishing & final packing. Methods used to maintain the quality standards are :

Stores : 10% inspection of the raw material.

Cutting : Checking fabric faults and cutting mistakes. (1.5 A.Q.L. standards)

Production :

- Inspecting 10 pcs/hr in every operation by the inline QC.
- 100% inspection for critical measurements.
- 100% end line inspection for sewing mistakes.

- 100% inspection after ironing.
- 100% inspection for appearance.

Packing : 2.5 A.Q.L STD. inspection before packing.

Final Checking : 0.65 A.Q.L inspection after packing. (Accuracy)