

# A New Quality Control Tool to Assess Quality Management Performance in Textile and Garment Factories

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## ABSTRACT

In the Jordan Journal of Mechanical and Industrial Engineering, Volume 4, N°6, 2010, Fouad and Mukattash have worked on “Statistical Process Control Tools: A Practical Guide for Jordanian Industrial Organizations”. The purpose of this paper is to contribute to such Guide by identifying another measure of quality assurance or quality performance. We have collected data from two exporting factories, textile and garment. The data mining is conducted to identify a measure or a mapping. Result reveals and proposes a trapezoid, which permits to map quality assurance performance. There are a few limitations for this paper. First, only cases with work and rework operations are concerned. Second, this paper is confined only to answer if quality assurance is correct or not. This paper serves as an alert for factories to review their quality assurance programs and to conduct cause and effect assessments on a regular basis in order to correct the process. It shows a new important tool which is not studied in many past researches. This paper also looks at quality assurance practices from the textile and garment industries where quality process is usually and rigorously conducted.

**Keywords:** *Garment, Jordan, Madagascar, Quality Assurance, Quality Management, Textile*

## 1. INTRODUCTION

In the Jordan Journal of Mechanical and Industrial Engineering, Volume 4, N°6, 2010, Fouad and Mukattash have worked on “Statistical Process Control Tools: A Practical Guide for Jordanian Industrial Organizations” [1]. The authors have cited and utilized seven tools in a case study on Jordanian Steel Manufacturing Company. These tools are Pareto Diagram, Cause and Effect Diagram, Check Sheets, Process Flow Diagram, Scatter Diagram, Histogram and Control Chart. In other domain of research, Al-Shobaki, Fouad and Al-Bashir have studied implementation of Total Quality Management for the Banking Sector in Jordan [2]. However, Jordan is leader among Arab countries in textile and garment, is there a tool to well map and to evaluate quality assurance performance?

In this research, we are going to propose another tool, especially for Jordan textile and garment industries.

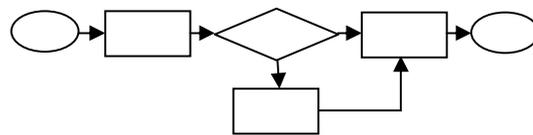
## 2. LITERATURE REVIEW

### 2.1 Generic tools

Some generic tools are developed for Statistical Process Control for problem solving and

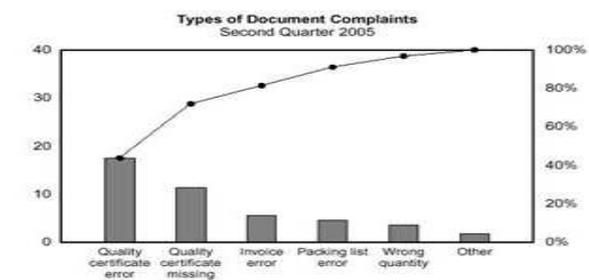
continuous improvement. They are utilized while analyzing quality problems. Coopers and Lybrand had identified some generic tools.

### Process Flow Diagram



It is a picture which describes the main steps, branches, feed backs and eventual outputs of a process.

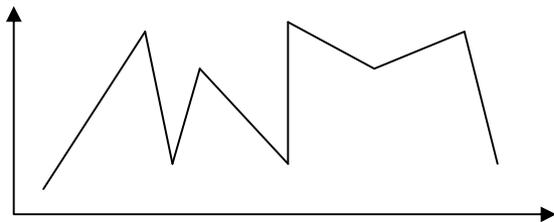
### Pareto Diagram



Source: Nancy R. Tague's "The Quality Toolbox", Second Edition, ASQ Quality Press, 2005, pages 376-378.

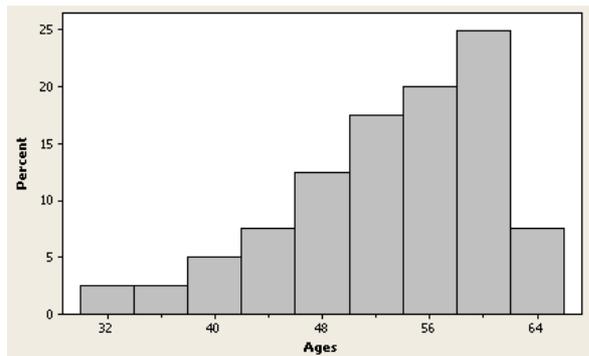
Pareto is a coordinated approach for identifying, ranking, and working to permanently eliminate defect. It focuses on important error sources, 80/20 rule: 80% of the problems are due to 20% of the causes.

### Run Chart



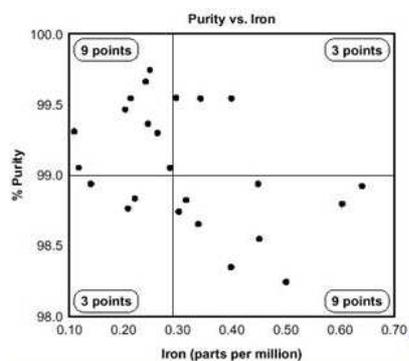
It is a time sequence chart showing plotted values of characteristic.

### Histogram



Histogram is a distribution showing the frequency of occurrences between the high and low range of data.

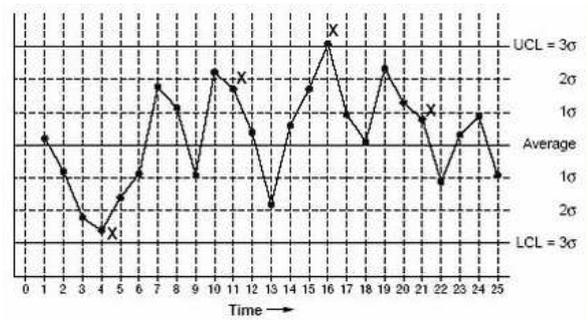
### Scatter Diagram



Source: Nancy R. Tague "The Quality Toolbox", Second Edition, ASQ Quality Press, 2005, pages 471-474

It is also known as a correlation chart. Scatter Diagram is a graph of value of one characteristic versus another characteristic.

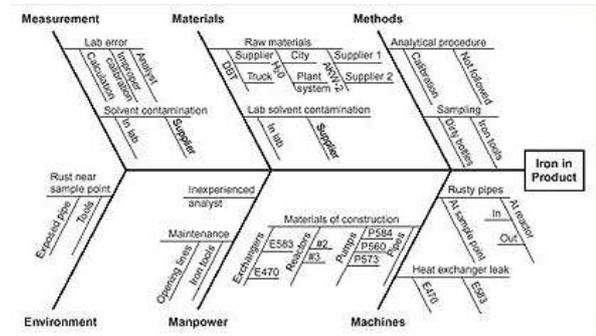
### Control Chart



Source: Nancy R. Tague "The Quality Toolbox", Second Edition, ASQ Quality Press, 2005, pages 155-158.

That chart is a time sequence one showing plotted values of a statistic, including a central line and one or more statistically derived control limits.

### Causes and Effect Diagram



Source: Nancy R. Tague "The Quality Toolbox", Second Edition, ASQ Quality Press, 2005, pages 247-249

It is a tool that uses a graphical description of the process elements to analyze potential sources of process variation.

### Checksheets

Reason	Day					Total
	Mon	Tues	Wed	Thurs	Fri	
Wrong number						20
Info request						10
Boss						19
Total	12	6	10	8	13	49

Excerpted from Nancy R. Tague "The Quality Toolbox", Second Edition, ASQ Quality Press, 2005, pages 141-142.

A Checksheet is an organized method for recording data.

Jordan garment industry plays a principal part in Jordan industry sector. It contributes in direct foreign and local investment for about US\$ 700 million [3]. Moreover, export to the United States or US market is US\$ 770 million according to Al Khoja [3]. Importing country is not only the US but also the European Union countries or EU. Because the Jordan export target market is the US and the EU countries [4]. Their imports from Jordan are increasing because free of duty and quota [4].

Niche is not only garment but also textile. A US International Trade Commission study predicted that Jordanian exports would increase measurably in only one sector, textile and apparel [5]. Besides, many agreements make Jordan a strong competitor in the world garment and textile market [6]. These agreements are: General Agreement on Tariffs and Trade or GATT, Jordan-European Union Association Agreement and the General Agreement or Services or GATS, and Jordan-United States Free Trade Agreement.

As a result, textile and garment industries are important. Over 55,000 people are employed in

the sector, which is about 1/3 of Jordan's industrial labor force [6]. In addition, over 30% of Jordan's total exports are from textile and garment manufacturing sector.

Al Khoja has noted that the future of garment and textile sector needs "Research and Development Capabilities" [3]. He has even specified that improving the enterprises' productivity pass through quality management [3]. Practically, some training needs have been identified [4]:

- 900 middle level staff in quality control,
- Create a Jordanian capacity in quality management
- Train senior level staff in quality assurance management

Moreover, concerning program upgrading, "Quality Enhancement Program" is a principal axis [4].

### 3. METHODOLOGY

We have conducted research in two factories: textile and garment. We have collected data during 46 and 32 weeks respectively for textile and garment factories. And the research processes are presented by the following.

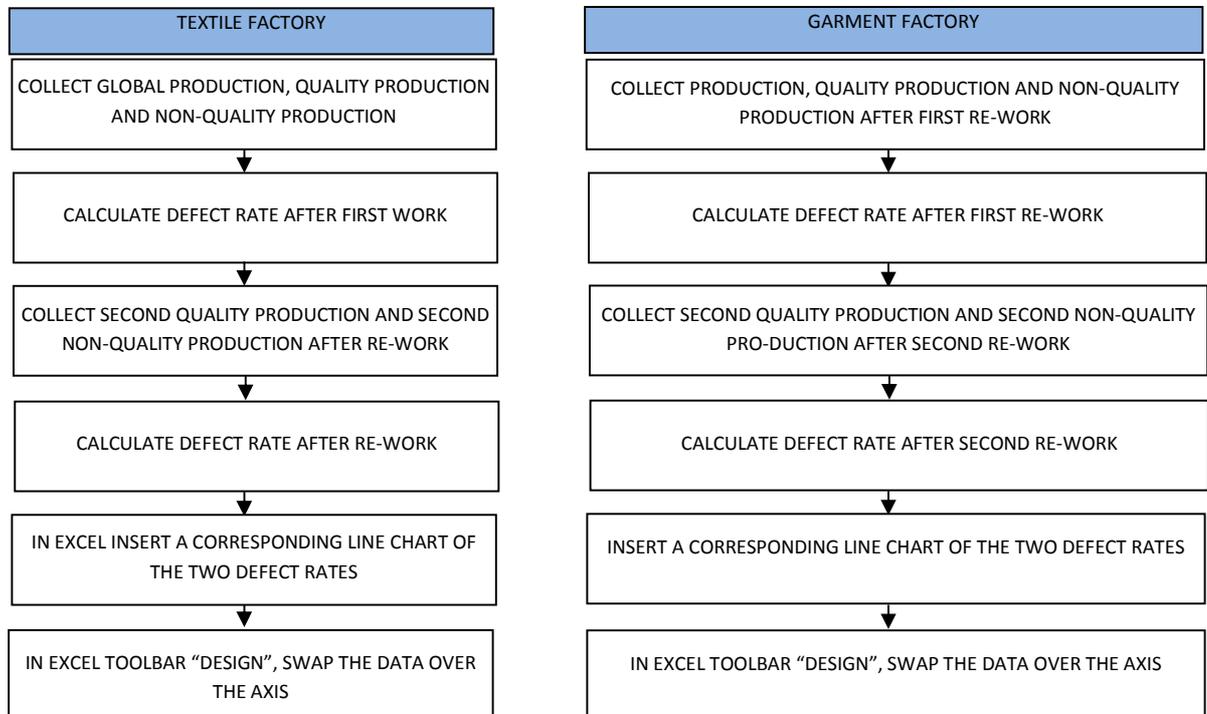


Figure 1: Research processes

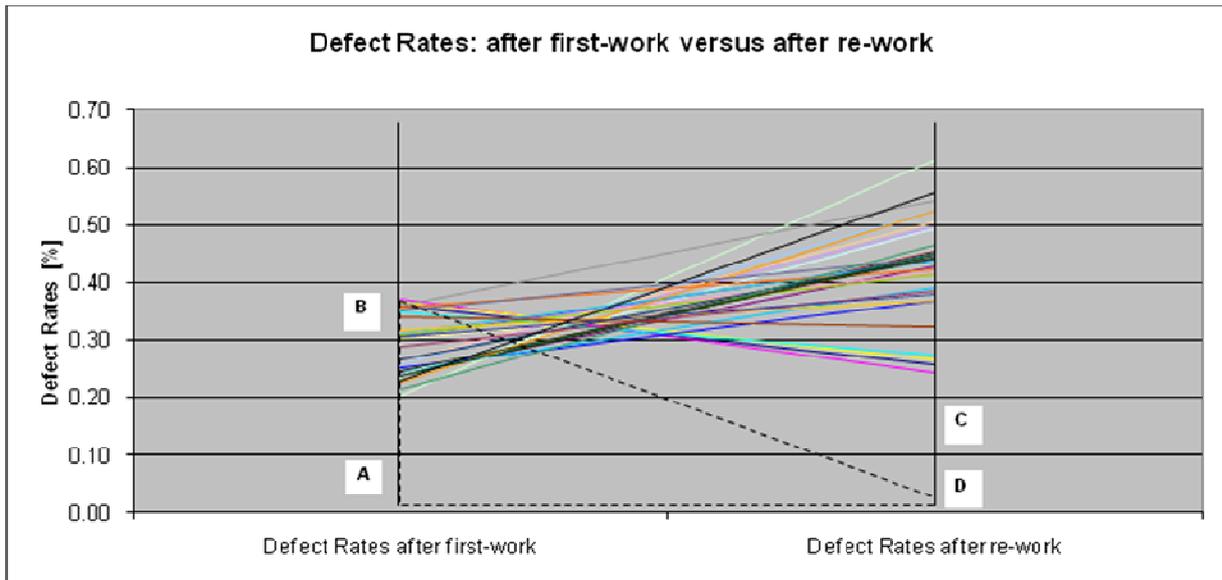
Each week, for the textile factory, we have collected global production ( $P_g$ ), production that conforms to quality requirements ( $P_q$ ) and non-quality ( $NQ_1$ ). Then after re-work of non-quality ( $NQ_1$ ), we have collected data that conforms to quality requirements ( $P_{q2}$ ) and non-quality ( $NQ_2$ ). The defect rate after first work is  $(NQ_1)/(P_g)$ . And, the defect rate after re-work is  $(NQ_2)/(NQ_1)$ .

quality production ( $P_q$ ) and non-quality production ( $NQ_1$ ). Then after re-work of non-quality production ( $NQ_1$ ), we have collected quality production ( $P_{q'}$ ) and non-quality ( $NQ_2$ ). The defect rate after first re-work is  $(NQ_1)/(P)$ . And the defect rate after second re-work is  $(NQ_2)/(NQ_1)$ .

#### 4. RESULTS

On the first hand, the textile case is observed. And the fig.1 shows the corresponding mapping.

At the same time, for garment factory at first re-work level, we have collected production ( $P$ ),



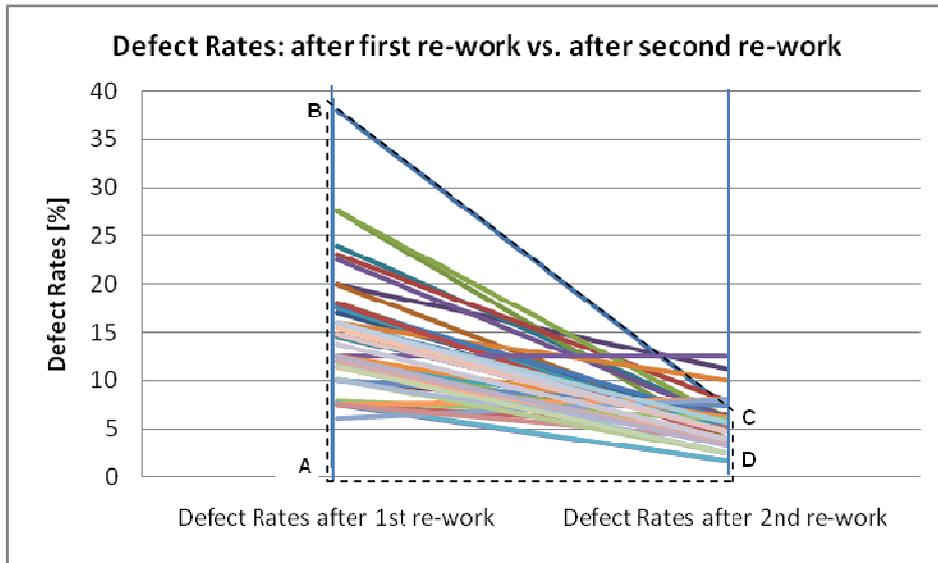
**Figure 2: Defect Rates Mapping of the Textile Case**

We notice a trapezoid ABCD. AB depicts the maximum defect rate of 37%. CD represents the minimum defect rate of 3%. The latter is the target defines in the quality assurance policy. The computer automatically determines the distance AD.

not comply with quality assurance target of 3%. 50% of defect rates after re-work are poorer than those after first work. In addition, 50% are merely the same as those after first work.

In the present case, all defect rates after re-work are over CD. Practice in the textile factory does

On the second hand, the garment case is studied. The following fig.2 shows the corresponding mapping.



**Figure 3: Defect Rate Mapping of the Garment Case**

In the garment case, we also perceive the trapezoid ABCD. AB gives a picture of defect rates after first re-work. And CD represents 6%, the maximum defect rate acceptable in the assurance quality policy. The computer automatically determines the distance AD.

After first re-work, the majority of defect rates are included in [6%,23%]. And after second re-work, the best part of defect rates are included in [0%,6%].

**5. DISCUSSION**

There is a tool to map and to evaluate quality assurance performance. It is the quality trapezoid. The results show that it is a new tool. It has some strengths and limits in comparison with control chart developed by Fouad and Mukattash [1].

Quality trapezoid and control chart have two things in common. Both have measurable variables. For quality trapezoid, they are time in abscissa and defect rate in ordinate. In addition, both are line chart. The origin of fig. 2 and 3 above is line chart. So why control chart and quality trapezoid are line chart. This constitutes strength for the quality trapezoid as far as it shows that the new tool belongs to the group of the Statistical Process Control Tools [1].

If control chart needs to be used in pairs [1], quality trapezoid is fully significant with one chart. It is quality trapezoid's strength. Two positions,

defect rates after first re-work and defect rates after second re-work in the garment case, may be observed in one chart and so make easy assessment. In the textile case, a same chart depicts two positions; defect rates after first work and defect rates after re-work. With quality trapezoid, we can report on quality assurance. Quantitative assessment is practically possible. It is again quality trapezoid's strength.

However, quality trapezoid cannot mention the causes of quality assurance fails. This is a limit. In quality management "causes" are important not only for lessons learned but also for solving the problems. In quality trapezoid, we just see the problem but we cannot solve it because we do not know its causes. Control chart can be used as dashboard and our quality trapezoid can be used as performance evaluation.

Related to the Fuzzy Approach to Quality Evaluation Processes [7], we use continuous scale in ordinate in terms of defect rates. Besides, the above figures express positions that are not extremes but intermediate, revealing organizations present evolution in terms of quality assurance. Therefore, our findings fit the Fuzzy Approach.

**6. CONCLUSION**

A new control chart named by "Quality Trapezoid" is a new finding. It permits to map quality control and to assess quality assurance performance. It has some advantages related to control chart:

easy in mapping and easy in assessing quality assurance performance of a textile or garment enterprise.

#### *When to use a Quality Trapezoid?*

Quality Trapezoid is used when an enterprise's product is concerned about work and rework. It permits to measure the performance of the enterprise in terms of quality management.

#### *Quality Trapezoid Procedure*

- Subdivide production in many lot sizes,
- For each lot, control and collect defect items and calculate corresponding rate,
- Rework defect items then control and collect defect items after rework. Then calculate corresponding rate,
- Report data in excel table,
- Select data per time unit and choose line chart to map the data.

However, it cannot point out the causes of non-quality. Those causes are necessary for improvement. That limit of Quality Trapezoid generates some future researches:

- Coupling quality trapezoid and cause and effect diagram to better assess quality assurance,
- Coupling Intelligent Quality Function Deployment, as developed by Daws

and al. [8], and quality trapezoid into computerized environment

## **7. REFERENCES**

- [1]. R.H. Fouad, A. Mukattash, "Statistical Process Control Tools: A Practical Guide for Jordanian Industrial Organizations", Jordan Journal of Mechanical and Industrial Engineering", Vol.4, N°6, 2010, 693-700.
- [2]. S. D. Al-Shobaki, R.H. Fouad, A. Al-Bashir, "The Implementation of Total Quality Management (TQM) for the Banking Sector in Jordan", Jordan Journal of Mechanical and Industrial Engineering", Vol.4, N°2, 2010, 304-313.
- [3]. Al Khoja R. in "Garment Sector in Jordan: Facts and Figures", <http://www.qsc-jo.com> accessed January 4, 2012.
- [4]. EJADA, "Strategy and Action Plan to Enhance the Competitiveness of the Garment Industry in Jordan", 2010.
- [5]. "A US-Jordan Free Trade Agreement Would Have No Measurable Impact on US Production or US Employment", International Trade Commission, News Release 00-122, September 26, 2000, <http://www.usitc.gov/er/n2000/ER0926X1.HTM> accessed January 4, 2012.
- [6]. "Jordan: Rising Demand For Indian MMF Textile Exports", [http://www.srtepc.org/mr\\_jordan.pdf](http://www.srtepc.org/mr_jordan.pdf) accessed November 11, 2011.
- [7]. E. P. Paladini, "A Fuzzy Model for Quality Evaluation Processes", International Journal of Computers, Vol.1, Iss.4, 2007.
- [8]. K. Daws, Z. A. Ahmed, A. A. Moosa, "An Intelligent Quality Function Deployment (IQFD) for Manufacturing Process Environment", Vol.3, N°1, 2009, 23-30.