Proposed Improvement of Flour Quality by using New Seven Tools Method (Case Study: XYZ Company)

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Abstract. The quality of flour is a matter that must be considered as the main output in the production process, in this case each type of flour has a different standard specification, the quality of the flour is determined by 3 main factors contained in the flour, namely moisture, protein and Ash content. The specifications of the three main factors must be achieved in order to produce quality flour and suitable for use according to the type of flour. Disruption in the production process can cause the quality of a flour not reached / not in accordance with the specifications, things that can cause disruption in the production process can be caused by several factors, namely the quality of raw materials, human factors, machine factors in the production process, work methods and work environment in the production process. So, this research was conducted using the new seven tools method to find out the main causes of quality problems in wheat flour and to find proposals to improve the quality of wheat flour. The application of this method suggests making a monitoring schedule because the main problem found in the field is not monitoring closely.

1. Introduction
On the off chance that the consequences of QC tests can't satisfy the acknowledgment models, the aftereffects of examination of the entire arrangement of the estimations on that day must be eliminated or should be re-dissected, and an incomplete or full re-approval of the strategy considered [12]. PT. XYZ is a factory that processes wheat raw materials into finished products in the form of wheat flour. The quality of flour is a matter that must be considered as the main output in the production process, in this case each type of flour has a different standard specification, the quality of the flour is determined by three main factors contained in the flour, namely moisture, protein and Ash content [1]. The specifications of the three main factors must be achieved in order to produce quality flour and suitable for use according to the type of flour. Disruption in the production process can cause the quality of a flour not reached / not in accordance with its specifications, things that can cause disruption in the production process can be caused by several factors, namely the quality of raw materials, human factors, machine factors in the production process, work methods and work environment in the production process.

This research was conducted at the milling department where in this region the production of X-type flour products, this department is very crucial in determining the quality of flour produced because the entire process from cleaning and grinding flour to finished products is carried out in this department. The problem that occurs in the mill department is not achieving the specifications of
moisture, protein and ash in flour. Analysis of the problems contained in the milling department of PT. XYZ is done by using new seven tools to find out the problems affecting the quality of wheat flour. The Food Industry is demanded to be able to provide attractive processed food products of good quality, nutritious, safe and have a price that is affordable by people’s purchasing power. In addition, customer satisfaction is one of the keys for companies to improve their quality. Consumer satisfaction is the feeling of consumers in the services they receive from the company that provides it. Thus, customer satisfaction is the most important factor in developing processes and building relationships with consumers [2].

### Table 1. Total defects in flour

| No | Number of Samples examined (n) | Moisture Content | Protein Content | Ash Content | Total Defects / Day |
|----|-------------------------------|------------------|-----------------|-------------|---------------------|
| 1  | 9                             | 0                | 0               | 1           | 1                   |
| 2  | 9                             | 1                | 2               | 2           | 5                   |
| 3  | 9                             | 2                | 0               | 0           | 2                   |
| 4  | 9                             | 1                | 1               | 2           | 4                   |
| 5  | 9                             | 2                | 1               | 1           | 4                   |
| 6  | 9                             | 1                | 2               | 1           | 4                   |
| 7  | 9                             | 2                | 0               | 1           | 3                   |
| 8  | 9                             | 2                | 1               | 2           | 5                   |
| 9  | 9                             | 3                | 1               | 2           | 6                   |
| 10 | 9                             | 2                | 0               | 1           | 3                   |
| 11 | 9                             | 0                | 0               | 0           | 0                   |
| 12 | 9                             | 1                | 1               | 0           | 2                   |
| 13 | 9                             | 2                | 1               | 2           | 5                   |
| 14 | 9                             | 3                | 1               | 2           | 6                   |
| 15 | 9                             | 1                | 1               | 1           | 3                   |
| 16 | 9                             | 1                | 1               | 1           | 3                   |
| 17 | 9                             | 1                | 1               | 1           | 3                   |
| 18 | 9                             | 0                | 0               | 0           | 0                   |
| 19 | 9                             | 0                | 1               | 0           | 1                   |
| 20 | 9                             | 0                | 2               | 0           | 2                   |
| 21 | 9                             | 0                | 1               | 1           | 2                   |
| 22 | 9                             | 2                | 1               | 2           | 5                   |
| 23 | 9                             | 1                | 0               | 2           | 3                   |
| 24 | 9                             | 3                | 0               | 1           | 4                   |
| 25 | 9                             | 0                | 2               | 1           | 3                   |
| 26 | 9                             | 0                | 0               | 0           | 0                   |
| Total | 234                      | 31               | 21              | 27          | 79                  |

2. **Research Methodology**

The study was conducted at PT. XYZ, where the data taken are Moisture Content, Protein Content and Ash content contained in Flour. The study uses New seven tools. The function of the New seven control devices is to improve process improvement, so that it will be obtained [3,4]:

- Increased competitiveness.
- Decreasing cost of quality and increasing price flexibility.
- Increase resource productivity.
2.1. Data Collection
Data can be obtained from two main sources namely primary sources and secondary sources. Data obtained from primary sources is called primary data, that is data obtained by searching / digging directly from the source by the relevant researcher. Secondary data is data that has been collected and processed by other parties so that it does not need to be explored / sought by the relevant researcher but only to quote or retrieve [5].

2.2. Data Processing Method
The data processing steps taken are as follows [6]:

- **Affinity Diagrams**
  Affinity diagrams help a group find a set of themes and ideas that can be used later. Affinity diagrams create a hierarchy of ideas on a large surface.

- **Interrelationship Diagram**
  Interrelationship Diagrams show relationships between different issues, after completing an affinity diagram, it will be very useful to know the causal relationships between different issues on the surface.

- **Tree Diagram**
  Tree diagrams are useful for identifying the steps needed to solve an existing problem.

- **Matrix Diagram**
  The matrix diagram has the same concept as the quality function deployment on how to use it for symbols, layout, and applications. Matrix diagrams are brainstorming tools that can be used to show relationships between different ideas.

- **Prioritization Grid**
  Prioritization Grid is used to make decisions based on several criteria. As an example in choosing a technology, we can have a variety of choices. In addition, the decision criteria also vary, such as how to choose the desired results. When having several alternatives and criteria, a priority matrix is a useful method for informing decision makers without resorting to complex analysis.

- **Process Decision Program Chart**
  Process Decision Program Chart is a tool to help brainstorm possibilities or problems related to the implementation of several programs or development.

- **Arrows Diagram**
  Arrow diagrams are used to find the path used to control production activities.

This study was conducted at XYZ company on Flour products. The data used in this study is secondary data while the data is obtained indirectly which can form file documents, archives or company records. XYZ Company itself collects disability data by taking samples 9 times a day after which it is tested for moisture, protein and ash content. This study uses New seven tools in data processing, of which seven tools consist of

- Affinity Diagram
- Interrelationship Diagram
- Tree Diagram
- Matrix Diagram
- Prioritization Grid
- Process Decision Program Chart
- Arrows Diagram
3. Result

From the defect data obtained then identified the main causes of problems in the specification of wheat flour using a Pareto diagram. Pareto diagram is useful for finding or finding priority problems found in the production process of a company, then the problem is solved by determining the priority or importance of the percentage of types of defects using the bar graph format. In the Pareto diagram, disability is sorted from the largest percentage to the smallest percentage and seen the cumulative percentage of each defective product, the cumulative percentage of 100% shows the total loss or total disability of a production process. Pareto diagram showing disability priority data can be seen in the following figure [7,8].

![Pareto Chart of Types Of Defects](image)

**Figure 1.** Pareto diagram

The causes of defects and the proposed improvement of flour will then be analyzed by the new seven tools method.

3.1. Affinity Diagram

![Affinity Diagram](image)

**Figure 2.** Affinity diagram
Based on the diagram above, it can be concluded that the problems that cause disability in the quality standard of the product are grouped into 5 parts: Human, Raw Materials, Machines, Work Methods and Work Environment. This grouping aims to facilitate the identification of the cause of the problem.[9,10]

3.2. Interrelationship Diagram

From the picture above it can be concluded that the factor of not monitoring closely becomes the factor with the most outward direction so that it becomes the main factor and the product yield factor not in accordance with quality standards becomes the factor with the most incoming arrows so that it becomes a performance indicator.

3.3. Tree Diagram

Based on the diagram above, there are three objectives to be achieved, namely:

- A reward and penalty system is given to the operator
- Conduct periodic monitoring
- Periodic checks on raw materials
3.4. Matrix Diagram

Table 2. Matrix diagram

| Resources Required | Capital Investment | Training Time | Certification Assessment |
|--------------------|--------------------|---------------|--------------------------|
| Solution                        | Δ                  | Δ             | Δ                        |
| Evaluating Operator Performance | Δ                  | Δ             | Δ                        |
| Reward if the operator is working optimally | •                  | Δ             | Δ                        |
| A Penalty System is applied to the operator | •                  | Δ             | Δ                        |
| Following the SOP of Work       | Δ                  | Δ             | Δ                        |
| Make a Monitoring Schedule      | Δ                  | Δ             | Δ                        |
| Maximizing Wheat Cleaning       | o                  | o             | •                        |
| Wheat Check Before Going To Silo | o                  | o             | •                        |

Information:
• = Strong Relationship
o = Moderate relationship
Δ = Weak relationship

From the above data it can be concluded that the solution chosen is the one that requires the lowest resources, namely: (i) Evaluate Operator Performance, (ii) Following the SOP of Work and (iii) Make a Monitoring Schedule

3.5. Prioritization Grid

Table 3. Prioritization grid

| Criteria | Option                        | Capital Investment | Training Time | Certification Assessment | Importance Score Sum | Option Ranking |
|----------|-------------------------------|--------------------|---------------|--------------------------|----------------------|----------------|
|          | Evaluating Operator Performance | 0,3                | 0,5           | 0,3                      |                       |                |
|          |                                | Percentage Weight  | 1              | 2                        | 3                    | 2,2            | 2              |
|          |                                | Importance Score   | 0,3            | 1                        | 0,9                  |                |
|          | Following the SOP of Work     | 0,4                | 0,4           | 0,2                      |                       |                |
|          |                                | Percentage Weight  | 3              | 1                        | 1                    | 1,8            | 1              |
|          |                                | Importance Score   | 1,2            | 0,4                      | 0,2                  |                |
|          | Make a Monitoring Schedule     | 0,3                | 0,6           | 0,2                      |                       |                |
|          |                                | Percentage Weight  | 1              | 3                        | 1                    | 2,3            | 3              |
|          |                                | Importance Score   | 0,3            | 1,8                      | 0,2                  |                |
|          | Sum Of Weights                 | 1,0                | 1,5           | 0,7                      |                       |                |
|          | Average Weight                 | 0,3                | 0,5           | 0,23                     |                       |                |
|          | Criterion Ranking              | 2                  | 3             | 1                        |                       |                |
From the above results obtained, from the vertical axis the most important selection criteria are training time and horizontally the selected option is the monitoring schedule.

3.6. Process Decision Process Chart

![Process Decision Process Chart](image)

**Figure 4.** Process decision process chart

From the diagram above it can be seen a solution if there is a problem in the field, namely:

- Monitoring adjacent processes
- Brainstorm with workers
- The Head of Department directly oversees the process.

3.7. Arrow Diagram

Arrow diagrams are used to find the path used to control production activities. The arrow diagram allows you to calculate the project's "critical path". This is an important step in the flow where delays will affect the time of the entire project and where additional resources can accelerate the project.[11]

**Table 4.** Production monitoring schedule

| No. | Name of Activity                                      | Predecessor |
|-----|-------------------------------------------------------|-------------|
| 1.  | Record Consumer Demand                                | -           |
| 2.  | Adjusting demand with wheat stocks                   | 1           |
| 3.  | Establish Deadline                                    | 2           |
| 4.  | Develop a production schedule                         | 3           |
| 5.  | Routinely checking the development of production.    | 4           |
| 6.  | Contact the department concerned with production activities for a smooth process | 5           |
| 7.  | Review and maintain work records                      | 6           |

![Arrow Diagram](image)

**Figure 5.** Arrow diagram
The whole improvement process that is applied to the new seven tools method is expected to reduce or minimize the quality standard defects in the resulting product where it is found that the factor making the monitoring schedule becomes the main proposal for improving the production process on wheat flour.

4. Conclusion
The whole improvement process that is applied to the new seven tools method is expected to reduce or minimize the quality standard defects in the resulting product where it is found that the factor making the monitoring schedule becomes the main proposal for improving the production process on wheat flour. Based on the results of data processing and analysis that has been done, some conclusions can be drawn as follows:

- The Quality of Wheat Flour is influenced by 3 main factors namely Moisture, Protein and Ash Content.
- Moisture content is the most type of disability that occurs in wheat flour.
- Based on the evaluation results using the new Seven tools method, it can be concluded that the factor of not monitoring closely becomes the main factor causing wheat flour defect so that the improvement solution obtained is by making a monitoring schedule so that it can provide improvements for the company.

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References
[1] Fitriasari Eka 2009 *Jurnal Ilmu dan Teknologi Hasil Ternak* 4 (2) pp 17-29
[2] Rakhmawati et al 2013 Perbaikan Proses pada Pengolahan Tepung Terigu dengan Pendekatan Lean dan HACCP Sebagai Upaya Peningkatan Kualitas Tepung Terigu E-jurnal Manajemen Teknologi ITS 28 p 1
[3] Gaspersz Vincent 2001 *Metode Analisis untuk Peningkatan Kualitas* (Gramedia Pustaka Utama: Jakarta) p 102
[4] Ginting Rosnani 2007 *Sistem Produksi* (Graha Ilmu: Yogyakarta) p 62
[5] Sinulingga Sukaria 2018 *Metode Penelitian Edisi ke 3* (USU Press: Medan) p 45
[6] S Thomas Foster 2001 *Managing Quality* (Pearson) p 103
[7] Montgomery Douglas C 1985 *Statistical Quality Control* (AbeBooks) p 176
[8] Ronald E Walpole 1995 *Ilmu Peluang dan Statistika untuk Insinyur dan Ilmuwan* (Penebit ITB: Bandung) p 245
[9] Gaspersz Vincent 2001 *Total Quality Management* (Jakarta: Gramedia Pustaka) p 128
[10] M Nur Nasution 2005 *Manajemen Mutu Terpadu* (Bogor: Ghalia Indonesia) p 108
[11] Iman Soeharto 1999 *Manajemen Proyek* (Jakarta: Penerbit Erlangga) p 68
[12] Indrayanto G 2018 Recent development of quality control methods for herbal derived drug preparations *Natural Product Communications* 13 (12)