THE QUALITY ENGINEER PRIMER

WITH A LITTLE HELP FROM MY FRIENDS.

JOHN LENNON/PAUL McCARTNEY

Acknowledgments

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We would appreciate any comments regarding improvement and errata. It is our concern to be accurate.

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QUALITY IS NEVER AN ACCIDENT, IT IS ALWAYS THE RESULT OF INTELLIGENT EFFORT.

JOHN RUSKIN

Continuous Improvement

Continuous Improvement is presented in the following topic areas:

- **Quality Control Tools**
- **Management and Planning Tools**
- **Improvement Methodologies**
- **Lean Tools**
- **Corrective and Preventive Actions**

Quality Control Tools

Quality Control Tools are presented in the following topic areas:

- **Cause-and-Effect Diagrams**
- **Flow Charts**
- **Check Sheets**
- **Histograms**
- **Control Charts**
- **Pareto Diagrams**
- **Scatter Diagrams**

The following pages describe the seven quality control tools as well as other supporting activities that make these tools more effective. The flow chart in Figure 7.1 shows how the quality tools can be used to solve a problem or improve a process. The six basic problem solving steps are:

- **Identify the problem (Select a problem to work on)**
- **Define the problem (If a problem is large, break it into smaller pieces)**
- **Investigate the problem (Collect data and facts)**
- **Analyze the problem (Find all possible causes and potential solutions)**
- **Solve the problem (Select from the available solutions and implement)**
- **Confirm the results (Was the problem fixed? Was the solution permanent?)**

Problem Solving Using Control Tools

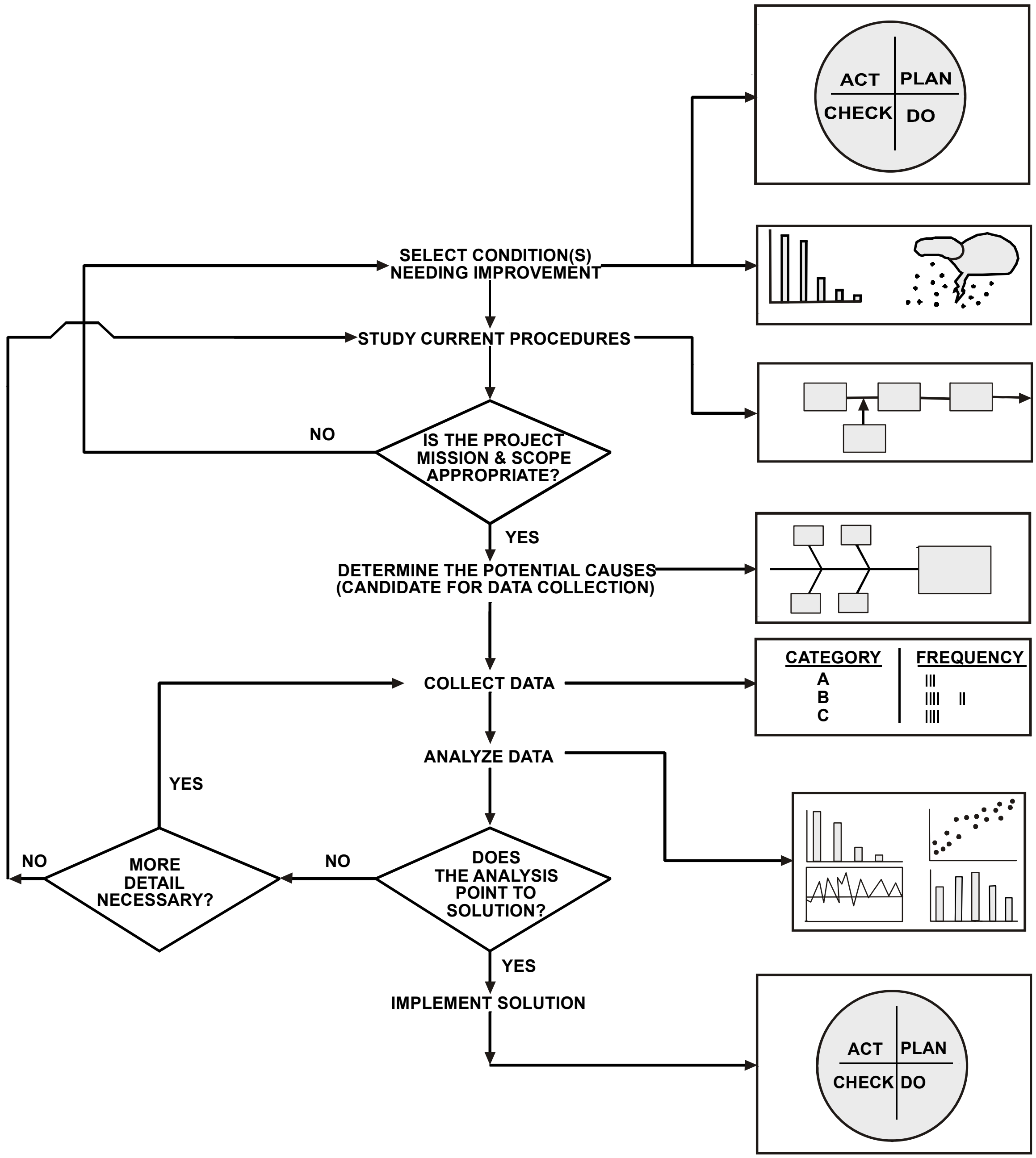

Figure 7.1 A Basic Problem Solving Methodology Showing the Use of Tools

Two extremely important steps in this process are to create a clear definition of the problem and to determine if the solution was effective in solving the original problem. Also, other problem solving techniques like PDCA and DMAIC can be used.

Cause-and-Effect Diagrams

The relationships between potential causes and resulting problems are often depicted using a cause-and-effect diagram which:

- **Breaks problems down into bite-size pieces**
- **Displays many possible causes in a graphic manner**
- **Is also called a fishbone, 4-M, or Ishikawa diagram**
- **Visually shows how various causes can combine to create a problem**
- **Follows brainstorming rules when generating ideas**

A fishbone session is divided into three parts: brainstorming, prioritizing, and development of an action plan. The problem statement is identified and potential causes are brainstormed into a fishbone diagram. Polling is often used to prioritize problem causes. The two or three most probable causes may be used to develop an action plan.

Generally, the 4-M (manpower, method, machine, material) version of the fishbone diagram will suffice. Occasionally, an expanded version must be used. In a laboratory environment, measurement is a key issue. For example, when discussing the brown grass in the lawn, environment is important. A 5-M and E schematic is shown in Figure 7.2.

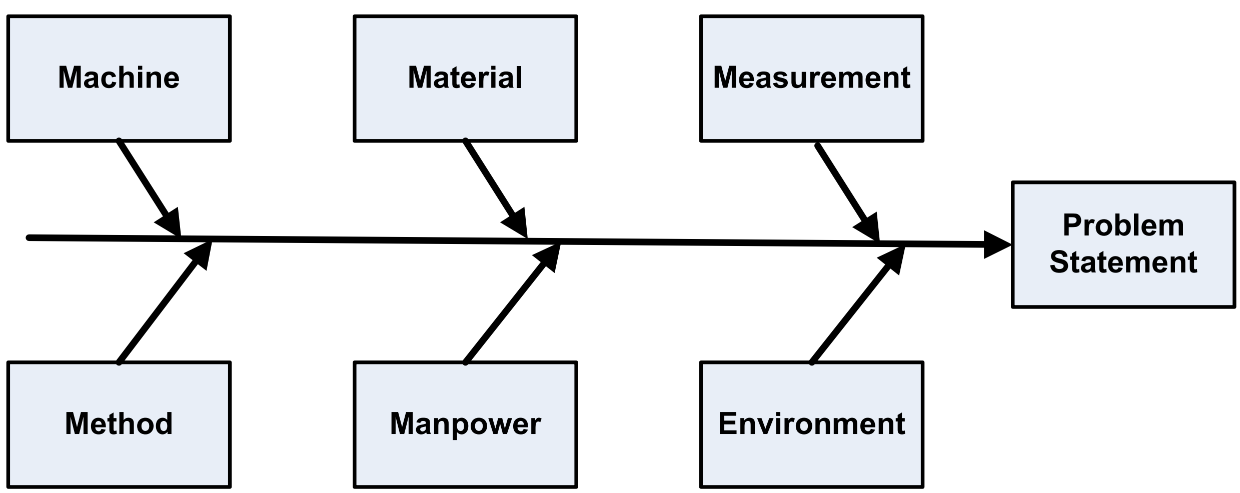

Figure 7.2 Basic Fishbone 5 - M and E Example

Cause-and-Effect Diagrams (Continued)

Figure 7.3 illustrates cause-and-effect diagram usage. A company was experiencing difficulty with inventory control of small mechanical parts. All parts were received and distributed based on weights (not actual counts).

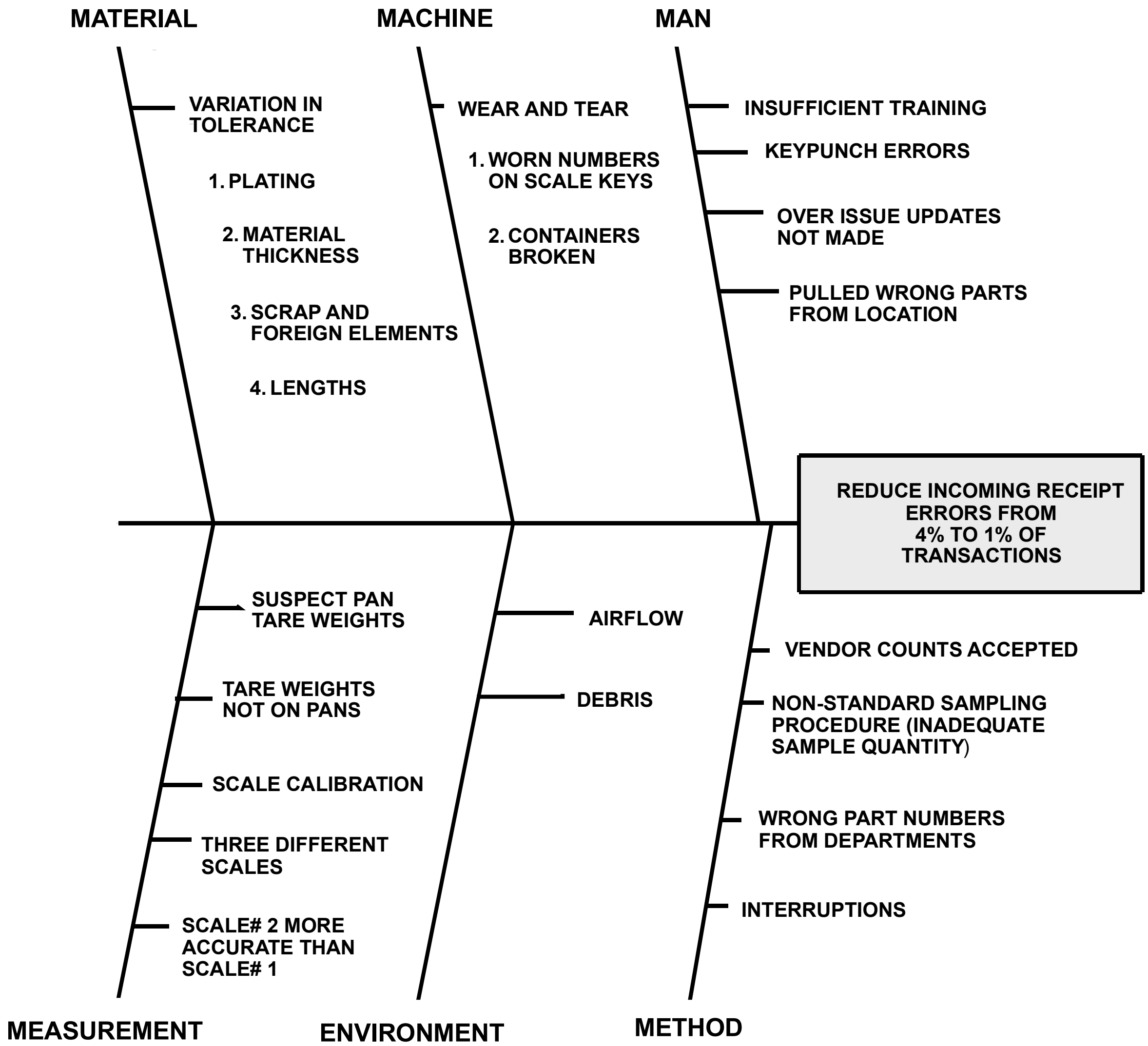

Figure 7.3 An Actual Fishbone Example

For additional examples of cause-and-effect or Ishikawa diagrams refer to: Ishikawa, K., (1982)[17]. Dr. Ishikawa attributed the first application of a cause-and-effect diagram to Tomiko Hashimoto's article, "Elimination of Volume Rotation Defects Through QC Circle Activities," Factory Work and QC, No. 33. (Hashimoto)[14].

Flow Charts

A flow chart, or process map, is useful both to people familiar with a process and to those that have a need to understand a process, such as an auditor. A flow chart can depict the sequence of product, containers, paperwork, operator actions or administrative procedures. A flow chart is often the starting point for process improvement. Flow charts are used to identify improvement opportunities as illustrated in the following sequence:

- **Organize a team for the purpose of examining the process**
- **Construct a flow chart to represent each process step**
- **Discuss and analyze each step in detail**
- **Ask the key question, “why do we do it this way?”**
- **Compare the actual process to an imagined “perfect” process**
- **Is there unnecessary complexity?**
- **Does duplication or redundancy exist?**
- **Are there control points to prevent errors or rejects? Should there be?**
- **Is this process being run the way it should?**
- **Can this process be performed differently?**
- **Improvement ideas may come from substantially different processes**

Process Flow Applications

Purchasing	**Processing purchase orders, placing actual purchases, vendor contract negotiations**
Manufacturing	**Processing returned goods, handling internal rejections, production processes, training new operators**
Sales	**Making a sales call, taking order information, advertising sequences**
Administration	**Correspondence flow, processing times, correcting mistakes, handling mail, typing letters, hiring employees**
Maintenance	**Work order processing, p.m. scheduling**
Laboratory	**Delivery of samples, testing steps, selection of new equipment, personnel qualification sequence, management of workflow**

Table 7.4 Process Flow Application Examples

