Cause and effect diagram

What is a Cause-and-Effect Diagram?

A cause & effect diagram is a simple but very effective tool that helps to identify, sort, and display potential or real causes of a specific problem or quality characteristic. It can also be used to graphically illustrate the relationship between a given outcome and all the factors that influence the outcome. Because of its function of relating causes to their effect, it is referred to as acause-and-effect diagram. It is also called afishbone diagrambecause the design of the diagram looks much like the skeleton of a fish. It is also known asIshikawa diagrambecause it was invented by Dr. Kaoru Ishikawa (1915-1989), a Japanese consultant, and father of the scientific analysis of causes of problems in industrial processes. He first used this diagram in 1943 at Kawasaki Steel Works Cause-and-Effect Diagram is a tool that helps identify, sort, and display possible

causes of a specific problem or quality characteristic (Viewgraph 1). It graphically

illustrates the relationship between a given outcome and all the factors that influence

the outcome. This type of diagram is sometimes called an “ Ishikawa diagram”

because it was invented by Kaoru Ishikawa, or a “ fishbone diagram” because of the

way it looks.

When should a team use a Cause-And-Effect Diagram?

Use cause & effect diagram when you want:

- To identify the possible causes or the basic reasons, for a specific effect, problem, or condition.
- To sort out and relate some of the interactions among the factors affecting a particular process or effect.

To analyze existing problems so that corrective action can be taken

Constructing a Cause-and-Effect Diagram can help your team when you need to

Identify the possible root causes, the basic reasons, for a specific effect,

problem, or condition.

Sort out and relate some of the interactions among the factors affecting a

particular process or effect.

Why should we use a Cause-and-Effect Diagram?

A cause & effect diagram helps to determine the causes of a problem or quality characteristic using a structured approach. It encourages group participation and utilizes team knowledge of the process. It uses an orderly, easy-to-read format to diagram cause-and-effect relationships. It increases knowledge of the process by helping everyone to learn more about the factors at work and how they relate. It indicates possible causes of variation in a process and identifies areas where data should be collected for further study.

A Cause-and-Effect Diagram is a tool that is useful for identifying and organizing the

known or possible causes of quality, or the lack of it. The structure provided by the

diagram helps team members think in a very systematic way. Some of the benefits

of constructing a Cause-and-Effect Diagram

Helps determine the root causes of a problem or quality characteristic

using a structured approach.

Encourages group participation and utilizes group knowledge of the

process.

Uses an orderly, easy-to-read format to diagram cause-and-effect

relationships.

Indicates possible causes of variation in a process.

Increases knowledge of the process by helping everyone to learn more

about the factors at work and how they relate.

How do we develop a Cause-and-Effect Diagram?

When you develop a Cause-and-Effect Diagram, you are constructing a structured,

pictorial display of a list of causes organized to show their relationship to a specific

effect. Viewgraph 3 shows the basic layout of a Cause-and-Effect Diagram. Notice

that the diagram has a cause side and an effect side. The steps for constructing and

analyzing a Cause-and-Effect Diagram are outlined below.

The application of cause-and-effect diagrams to the evaluation of thermodynamic data from UV-Vis absorption spectroscopic analysis is demonstrated. The contributions of measurement uncertainty identified from a cause-and-effect diagram are implemented into a Monte Carlo procedure based on the threshold bootstrap computer-assisted target factor analysis (TB CAT). This algorithm aims at an improvement of data comparability and accounts for non-normality, spectral, residual and parameter correlation as well as random noise in target factor analysis. The ISO Type-B measurement uncertainties are included into the process by normally distributed random numbers with specified mean values and dispersions. The TB CAT procedure is illustrated by a flow diagram and a case study of Nd(III) complexation by picolinic acid N-oxide (pic NO) in aqueous solution. Using 12 experimental spectra as input data, the single component spectra and the formation constant 1g betaML of the Nd(pic NO)2+ species are obtained together with the respective probability density distributions. The role of the cause-and-effects approach on the further development of chemical thermodynamics is discussed

Identify and clearly define the outcome or EFFECT to be analyzed

Decide on the effect to be examined. Effects are stated as particular quality characteristics, problems resulting from work, planning objectives, and the like.

Use Operational Definitions. Develop an Operational Definition of the effect to ensure that it is clearly understood.

Remember, an effect may be positive (an objective) or negative (a problem), depending upon the issue that's being discussed.

Using a positive effect which focuses on a desired outcome tends to foster pride and ownership over productive areas. This may lead to an upbeat atmosphere that encourages the participation of the group. When possible, it is preferable to phrase the effect in positive terms.

Focusing on a negative effect can sidetrack the team into justifying why the problem occurred and placing blame. However, it is sometimes easier for a team to focus on what causes a problem than what causes an excellent outcome. While you should be cautious about the fallout that can result from focusing on a negative effect, getting a team to concentrate on things

that can go wrong may foster a more relaxed atmosphere and sometimes

enhances group participation.

Identify, clearly state and agree on the effect or the problem to be analysed. A problem can be defined as a discrepancy between existing and a desired state of affairs. A problem exists when there is a difference between what “ should be” and what “ is”; between the ideal and the actual situation. Identifying a very clearly defined and specific problem is the first critical step to successfully implementing any problem-solving process. A symptom differs from a problem in that the symptom is an evidence of the existence of a problem

Place a white board or flipchart where everyone could clearly see it.

Draw a box containing the problem or effect to be analyzed, on the right side of the board with a horizontal spine.

Add main categories of possible causes of the problem. Causes in a cause & effect diagram are frequently arranged into the following categories:

1. The 6 Ms: Machine, Method, Materials, Measurement, Manpower and Mother Nature (Environment) (recommended for manufacturing industry).
2. The 8 Ps: Price, Promotion, People, Processes, Place / Plant, Policies, Procedures & Product (recommended for administration and service industries).
3. The 4 Ss: Surroundings, Suppliers, Systems, Skills (recommended for service industries).

4. The Processes: Process 1, Process 2, Process 3 and so on.

CAUSE & EFFECT DIAGRAMS – Cause and effect diagrams are very simple. The basic concept of a cause and effect diagram is to generate a fishbone diagram where all the causes of a problem against the effect (the effect is the fishes head with all the scales of the fish being the causes)

Cause and effect diagrams are best generated in brain storming sessions, when you are talking to the operators about making improvements. You can use them to view historical attempts at solving quality issues have worked out, get the operators involved, see if your proposals for improvement will work or not.

Cause and effect diagrams are useful; a lot of organizations do use the diagrams on quality control documents such as concession sheets where a cause and effect diagram must be completed every time there is any defective material. These diagrams would then be analyzed on a regular basis, to bring about improvements in product build.

FUTURE STATE – Develop a future state where you want your business to develop. By mapping the process, we should identify areas for improvement. By looking at rank order we observe further areas for improvements. Using cause and effect diagrams we see what has worked and what has not. The final state is to review and apply all we have learnt to how we get to where we want to be.

There are numerous other methods for analyzing your business for improvement, the above examples are for illustration purposes only, please be sure to read other quality publications.

Understanding Errors

The major underlying principle in all quality management systems, is to understand what causes errors in business and try to rectify and prevent them occurring again.

Errors can be attributed to:

- Poor training, which leads to mis-understanding and lack of perception.
- Production cycle based upon the use of time saving measures which result in poor product quality.
- Incorrect procedures covering the entire production cycle, rather than specific processes.
- Employee intentional action (as a result of poor labour relations, motivation, etc).

What quality systems aim to achieve by a reduction in errors:

- Proper identification of production process.
- Understanding how errors arise, and what could happen.
- Put measures in place to prevent the errors occurring again.

Having unstable processes in the production cycle leads to high levels of non-conforming material, which in itself leads to greater waste in the work place and lack of teamwork. Extensions to this are that your business will find itself having little or no direction, reduced profits due and lots of angry customers.

REFERENCES:

1. Brassard, M. (1988). The Memory Jogger, A Pocket Guide of Tools for Continuous Improvement, pp. 24 – 29. Methuen, MA: GOAL/QPC.

2. Department of the Navy (November 1992). Fundamentals of Total Quality

Leadership (Instructor Guide), pp. 6-25 – 6-29. San Diego, CA: Navy Personnel

Research and Development Center..

3. Ishikawa, Kaoru (1968). Guide to Quality Control. Tokyo, Japan: Asian

Productivity Organization.

4. U. S. Air Force (Undated). Process Improvement Guide – Total Quality Tools for

Teams and Individuals, p. 33. Air Force Electronic Systems Center, Air Force

Materiel Command.