WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 10, Issue 10, 1447-1455. Review Article ISSN 2277– 7105

COMPARATIVE STUDY BETWEEN FISHBONE PROJECT & SIX SIGMA PROJECT IN INDUSTRIAL BELTS

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Article Received on
28 May 2021,

Revised on 18 June 2021,
Accepted on 08 July 2021

DOI: 10.20959/wjpr202110-21397

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ABSTRACT

Six Sigma & Industry both words are made of eight letters and projection of these combo unts are reflected over Fishbone project which is also made of eight letters. The beauty of these combo units is highly utilized in industrial belts.

KEYWORDS: Six sigma, Fishbone, Manpower, Mind power, Machine, Material, Method, Measurement, Mission, Management, Money power, Maintenance, Product, Price, Place, Promotion, People, Process, Physical evidence, Performance. Surroundings, Suppliers, Systems, Skill, Continuous Improvement, Culture of Quality, Lean, Process Management, Root Cause Analysis, Statistics, Value Stream Mapping, DMAIC, DMADV, DFSS.


Figure 1: Two stalwarts in industrial exposure: Kaoru Ishikawa & William B. Smith.

Kaoru Ishikawa (Ishikawa Kaoru, July 13, 1915 – April 16, 1989) was a Japanese organizational theorist and a professor in the engineering faculty at the University of Tokyo noted for his quality management innovations. He is considered a key figure in the development of quality initiatives in Japan, particularly the quality circle.[1] He is best known outside Japan for the Ishikawa or cause and effect diagram (also known as the fishbone diagram), often used in the analysis of industrial processes. Ishikawa diagrams (also called fishbone diagrams, herringbone diagrams, cause-and-effect diagrams, or Fishikawa) are causal diagrams created by Kaoru Ishikawa that show the potential causes of a specific event.[2]

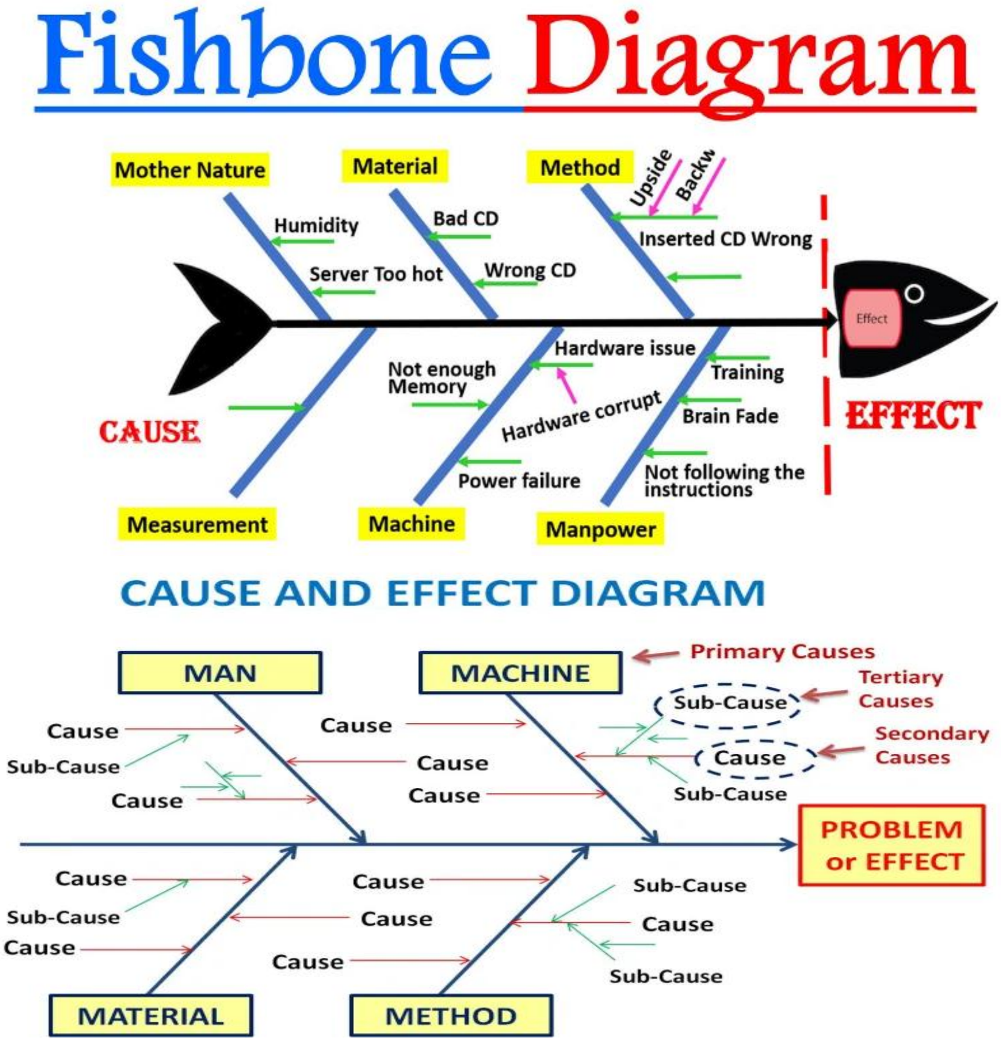

Figure 2: Fishbone diagram.

Common uses of the Ishikawa diagram are product design and quality defect prevention to identify potential factors causing an overall effect. Each cause or reason for imperfection is a source of variation. Causes are usually grouped into major categories to identify and classify these sources of variation.[3]

Advantages

1. Highly visual brainstorming tool which can spark further examples of root causes
2. Quickly identify if the root cause is found multiple times in the same or different causal tree
3. Allows one to see all causes simultaneously
4. Good visualization for presenting issues to stakeholders

Disadvantages

1. Complex defects might yield a lot of causes which might become visually cluttering
2. Interrelationships between causes are not easily identifiable.

Root-cause analysis is intended to reveal key relationships among various variables, and the possible causes provide additional insight into process behaviour.

The causes emerge by analysis, often through brainstorming sessions, and are grouped into categories on the main branches off the fishbone. To help structure the approach, the categories are often selected from one of the common models shown below, but may emerge as something unique to the application in a specific case.[4]

Each potential cause is traced back to find the root cause, often using the 5 Whys technique. Typical categories include:

The 5 Ms (used in manufacturing)
Originating with lean manufacturing and the Toyota Production System, the 5 Ms is one of the most common frameworks for root-cause analysis:

1. Manpower / mind power (physical or knowledge work, includes: kaizens, suggestions)
2. Machine (equipment, technology)
3. Material (includes raw material, consumables, and information)
4. Method (process)
5. Measurement / medium (inspection, environment)

These have been expanded by some to include an additional three, and are referred to as the 8 Ms:

1. Mission / mother nature (purpose, environment)
2. Management / money power (leadership)
3. Maintenance

The 8 Ps (used in product marketing).[5]

This common model for identifying crucial attributes for planning in product marketing is often also used in root-cause analysis as categories for the Ishikawa diagram:

1. Product (or service)
2. Price
3. Place
4. Promotion
5. People (personnel)
6. Process
7. Physical evidence (proof)
8. Performance

The 8 Ps are primarily used in product marketing.

The 4 Ss (used in service industries)

An alternative used for service industries, uses four categories of possible cause:

1. Surroundings
2. Suppliers
3. Systems
4. Skill

William B. Smith, Jr. (1929 – 1993) was the "father of Six Sigma". Born in Brooklyn, New York, Smith graduated from the U.S. Naval Academy in 1952 and studied at the University of Minnesota School of Management (now known as the Carlson School of Management). In 1987, after working for nearly 35 years in engineering and quality assurance, he joined Motorola, serving as vice president and senior quality assurance manager for the Land Mobile.[6]

Figure 3: Six sigma.

Six Sigma is a quality-control methodology developed in 1986 by Motorola, Inc. Six Sigma emphasizes cycle-time improvement while at the same time reducing manufacturing defects to a level of no more than 3.4 occurrences per million units or events.[7]

Six sigma topics

Continuous Improvement.

Culture of Quality.

Lean.

Process Management.

Root Cause Analysis (RCA)

Statistics.

Value Stream Mapping (VSM)

The Six Sigma Methodology comprises five data-driven stages — Define, Measure, Analyze, Improve and Control (DMAIC).

The name Six Sigma is derived from the bell curve used in statistics where one Sigma represents one standard deviation away from the mean. ... Like all processes, Six Sigma is also made up of two methodologies, which are DMAIC and DMADV or DFSS (Design for Six Sigma)

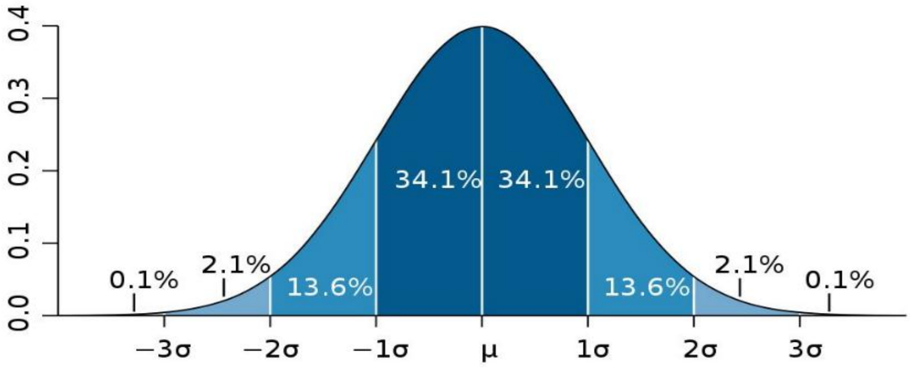

Figure 4: Six sigma curve.

In the instance of Six Sigma, standard deviation relates to data that can be expressed as fitting a normal distribution. A normal distribution curve, sometimes known as a "bell curve," is a plot of data where the three key measures of central tendency are all in the graph's center.[8]

In probability theory, a normal (or Gaussian or Gauss or Laplace–Gauss) distribution is a type of continuous probability distribution for a real-valued random variable. The general form of its probability density function is.

Normal Distribution Formula

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

$\mu =$ mean of x
$\sigma =$ standard deviation of x
$\pi \approx 3.14159 \ldots$
$e \approx 2.71828 \ldots$

Figure 5: Normal distribution formula.

The parameter π is the mean or expectation of the distribution (and also its median and mode), while the parameter σ is its standard deviation. The variance of the distribution is σ^2.

A random variable with a Gaussian distribution is said to be normally distributed, and is called a normal deviate.[9]

Figure 5: DMAIC & DMADV.

The DMAIC project methodology has five phases

Define the system, the voice of the customer and their requirements, and the project goals, specifically.

Measure key aspects of the current process and collect relevant data; calculate the "as-is" process capability. Analyze the data to investigate and verify cause and effect. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out the root cause of the defect under investigation.

Improve or optimize the current process based upon data analysis using techniques such as design of experiments, poka yoke or mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish process capability. Control the future state process to ensure that any deviations from the target are corrected before they result in defects. Implement control systems such as statistical process control, production boards, visual workplaces, and continuously monitor the process. This process is repeated until the desired quality level is obtained.[10]

Some organizations add a Recognize step at the beginning, which is to recognize the right problem to work on, thus yielding an RDMAIC methodology. Also known as DFSS ("Design For Six Sigma"), the DMADV methodology's five phases are:
Define design goals that are consistent with customer demands and the enterprise strategy.

Measure and identify CTQs (characteristics that are Critical To Quality), measure product capabilities, production process capability, and measure risks.

Analyze to develop and design alternatives.

Design an improved alternative, best suited per analysis in the previous step Verify the design, set up pilot runs, implement the production process and hand it over to the process owner(s).

CONCLUSION

The fishbone diagram is the most commonly used cause-and-effect analysis tool in Six Sigma. Cause-and-effect analysis is one of the key tasks in any Six Sigma DMAIC project because half of the game is won when the correct root causes of the problem (the Y) are found.

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