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Cause and Effect Diagram – An Inside Story

Kaoru Ishikawa – The Guru who proposed the Cause and Effect Diagram

The Second World War brought huge destruction to the Japanese community. Industries and businesses struggled as Japan began assessing the damage. Slowly but surely Japan began to rise, through brilliant concepts that helped Japan cope with the worst of scenarios. These concepts were a result of a dedicated clan of Japanese researchers and scientists who vowed to build a new Japan. One such brilliant and gifted researcher was Professor Kaoru Ishikawa.

Kaoru Ishikawa was born in 1915 in Japan. He graduated as an Applied Chemistry Engineer from the prestigious Tokyo University. He joined the same University as a lecturer and in 1947 became an Assistant Professor. Pursuing his higher studies at the same time he obtained the Doctoral degree in Engineering. This propelled him to the prestigious post of Professor in 1960.

Ishikawa's pioneering works in "Quality Control" earned him the "Deming Prize" and the "Nihon Keizai Press Prize". His successful program on quality control, earned him the "Grant Award" by the "American Society for Quality Control" in 1971. He died at the age of 74 in the April of 1988.

Kaoru Ishikawa – Rise to Fame

Dr. Ishikawa specialized in the Quality Circle movement in Japan during the 1960s. His pioneering work led him to invent the concept of Quality Circles.

Talking at the Quality Circle convention in Japan in 1981 Dr. Ishikawa explained how he ventured into quality control:

"I first considered how best to get grassroots workers to understand and practice Quality Control. The idea was to educate all people working at factories throughout the country but this was asking too much. Therefore, I thought of educating factory foremen or on-the-spot leaders in the first place."

Dr. Ishikawa had earlier been the Chairman of the Editorial Committee of the Genba-To-QC Magazine (A Quality Control magazine for the Foreman). Here he wrote on how to use ***simple quality control techniques and analysis to members in the Quality Circle***. The book was first published in Japanese. Hence, it was not very popular in the west.

Eventually the book was translated into English in 1971: *The Asian Productivity Organization published the latest version of Taguchi's book on Quality Control in 1986.*

Ishikawa also wrote a book called "What is Total Quality Control", which was translated into English in 1985.

Ishikawa's Ideas

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Ishikawa emphasized the use of statistical tools as a means to improve quality. He also suggested:

- Accurate data collection relevant to quality.
- Use of charts such as Pareto Diagrams to represent process quality.
- Cause and Effect Diagrams (Ishikawa or Fishbone).

Amongst these, Ishikawa stressed most on the use of Cause and Effect Diagrams. He believed that it was a perfect tool to aid Quality Circle members in enhancing product/process quality.

The Ishikawa (Cause and effect/fishbone) diagrams help determine the cause of a problem. They also estimate the effect of the problem. Cause and Effect Diagrams facilitate:

- Various categories of causes to be explored.
- Encourages creativity through a brainstorming process.
- Provides a visual image of the problem and potential categories of causes.

The next article to be launched on 22nd October 2003 will give a detailed graphical explanation on the Cause and Effect Diagram.

Apart from the Cause and Effect Diagram, Ishikawa also emphasized on the use of control charts, Pareto charts, scatter diagrams, Binomial probability paper and sampling inspection.

Company wide QC (quality control) – top Management initiative

Ishikawa was one of the gurus who took part in the Japanese Quality Control Movement during the 1950-1960, following the leads of Edward Deming and Joseph M. Juran. Hence, he too stressed on the need to view CWQC (company wide quality control) as a top management responsibility.

Also as the name suggests, the CWQC must encompass the entire management hierarchy, from the top management to the front line foreman.

According to Ishikawa:

“The results of these company-wide Quality Control activities are remarkable, not only in ensuring the quality of industrial products but also in their great contribution to the company's overall business”.

Cause and Effect Diagram

The Cause and Effect Diagram (Ishikawa) or the fishbone diagram, as it resembles the skeleton of the fish, is a tool to detect the root cause of a problem. It is widely used as it helps identify the main and associated causes leading to an effect (symptom) or a problem.

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It is one of the seven main tools used in quality control - Cause-and-Effect diagram, check sheet, control chart, flowchart, histogram, Pareto chart, and scatter diagram.

The Cause and Effect Diagram has been widely accepted because it

- Facilitates the study and effect of different root causes of a problem.
- Fosters creativity through brainstorming exercises.
- Presents a visual image of the problem and potential reasons for it.

How to develop a Cause and Effect Diagram

Focus on the problem based on priority or criticality. The next step is to categorize the problem. For instance, let us consider “High Employee Turnover”. Draw a diagram wherein this problem is represented graphically (far right as illustrated in figure-1).

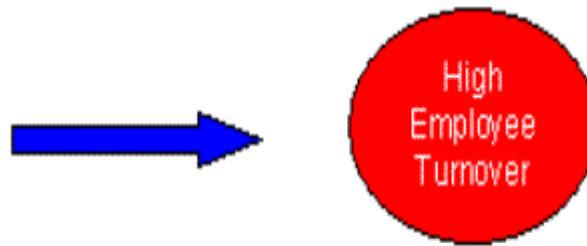


Figure - 1

Nevertheless, this might not be the actual problem. According to Ishikawa it could only be a symptom of the actual problem that will be detected in due course.

Alongside the symptom or the problem, draw an arrow. This arrow serves as the main path that branches out to sub causes/problems. Later, new categories and problems will branch out from the arrow as represented in figure – 2.

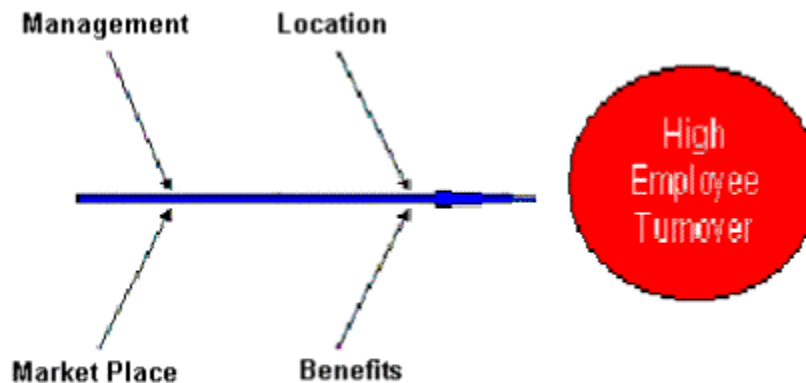


Figure - 2

The four causes for high employee turnover (i.e. management, locations, market place and benefits) can be determined through brainstorming exercises. Include as many people

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as possible in these brainstorming exercises. This improves the reliability of the Cause and Effect Diagram. The more people are involved, the more accurate the categorization of the causes for a problem will be.

Once the main causes (management, locations, market place and benefits) are identified, conduct brainstorming exercises for each of these causes. The horizontal lines represent these sub causes (Figure 3)

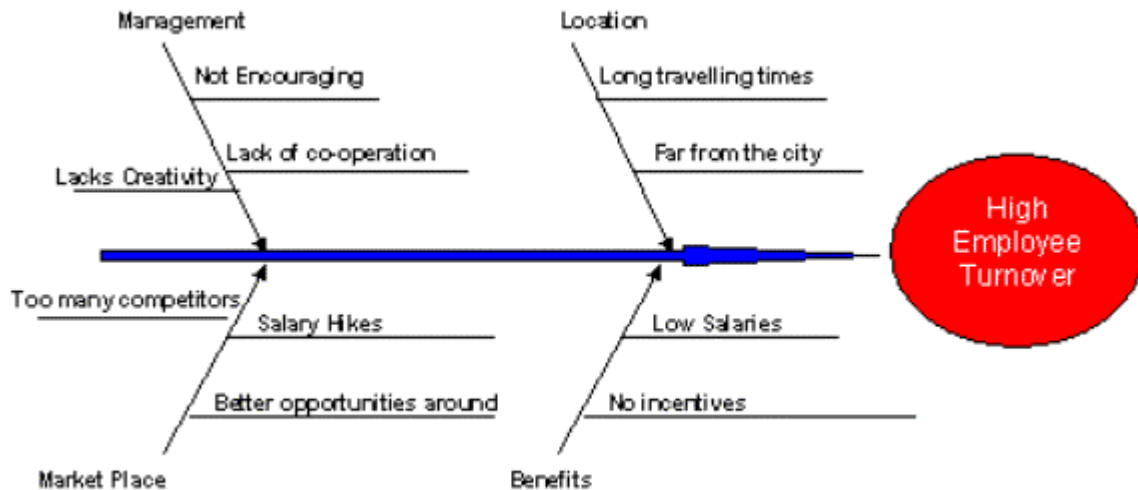


Figure - 3

Criticality of the sub causes

By identifying down the main problem and its causes, one could simply draw a Cause and Effect Diagram. However identifying the sub-causes and mapping them to the main causes it equally critical.

Why sub-causes

Sub-causes help determine the effect of the problem to a higher degree of accuracy. They also help improve the visibility of the reasons for the problem. Thus, by identifying the sub-causes the management can take clear steps to iron out the problems.

Comprehensive brainstorming

Brainstorming for the causes or the sub-cause must be comprehensive. Simply put, the larger the fishbone diagram, the easier it is to picture the root cause of the problem. This however demands the entire organization's participation. If coaxing the entire organization to participate is tedious, involve at least those employees who understand the problem.

Keep it simple

The causes, the sub-causes and the sub-sub-causes must be quantifiable. Causes beyond the organization's control, like weather conditions or legal hassles, should not be

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entertained. For a fishbone diagram to be readable and reliable the causes must be identifiable.

Dig deeper

Often vague causes might appear while constructing a fishbone diagram. Then it is recommended these causes be branched into identifiable causes. Simply put they must be broken down into simpler causes. Vague or unclear causes should be avoided in the fishbone diagram. They must be subjected to detailed analysis and their effects studied.

Use majority in case of disagreement

A brainstorming exercise can help determine most causes. However if there is disagreement over narrowing down to causes/sub-causes amongst employees, voting could solve the dilemma. Those with the highest majority are then put on the fishbone diagram.

Do not overlook any cause/sub-cause

Overlooking a cause/sub-cause might create an unreliable fishbone diagram. Be sure to conduct repeated brainstorming sessions to pen all possible sub-causes that lead to a specific cause.

Related causes

Often causes are relative. Hence create the fishbone diagram with relative causes as branching from one another. This improves the visibility of the cause and its effect. It might also facilitate a common solution to related causes.

Create actions plans

Once the fishbone diagram is complete, create clear action plans for solving the cases. Since few causes are of relative nature, actions plans must focus on catering to them as well.

CWQC

Ishikawa was amongst the very first to take part in the Japanese Quality Control Movement in 1950. This he did following what Edward Deming and Joseph M. Juran had preached during their visit to Japan in 1950.

Ishikawa believed that the CWQC has to be a top management initiative. His views on CWQC were:

“The results of these company-wide Quality Control activities are remarkable, not only in ensuring the quality of industrial products but also in their great contribution to the company's overall business”.

Ishikawa detested the idea of considering Quality as product quality. According to him quality encompasses everything from product quality to after-sales service to quality of management to every employee working the organization. Thus he termed it company wide quality.

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Why CWQC?

Ishikawa's idea of a robust CWQC was more than just another concept. He looked at CWQC as a potential tool to enhance organization performance by enhancing quality.

The following advantages grace an organization with a reliable and efficient CWQC policy.

- Enhancement of process/product quality, thereby standardization of quality. This in turn reduces non-conformities and defects within systems.
- Significant augmentation of the reliability of the product or service
- Massive reduction in operational costs as defects and non-conformities are eliminated.
- Substantial increase in productivity thereby improved performance and manufacturing schedules
- The entire manufacturing process is streamlined, as defective products do not enter the supply chain from the front end.
- Improved raw material supply as vendors who supply defective goods are eliminated
- Vendor supply base development
- New markets can be explored.
- Standardization improves inter department relationship
- Reduced occurrence of false data and information
- Facilitates feedback in the entire organization
- Feedback sessions and meetings bring the best out of all the employees.
- Drastic improvements in human relations as non-conformities are reduced, Thereby throwing blame on one another is ironed out

Quality Circles

Another major contribution from Ishikawa was his view on Quality Circles. In the year 1962 Japan was witnessing the Quality Circle Movement. The first Quality Circle to be registered in Japan was the Nippon Telegraph Public Corporation.

In Japan alone there are numerous registered Quality Circles not just limited to hard core manufacturing; they include everything from banking to import /export Quality Circles. In Western countries Quality Circles have not been so popular. Nevertheless its popularity is slowly but surely is catching up in the west.

What is a Quality Circle?

Typically, in Japan a Quality Circle would consist of workers/employees from the same company/unit. Headed by a foreman or a manager they meet periodically to discuss various issues relating to quality. Their main objectives are



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- Chalking out measures that enhance the unit/organization's performance.
- Protecting human relations and creating a working environment that fosters creativity.
- Leveraging human capabilities to improve organizational and individual performance.

How does a Quality Circle work?

All the members in a Quality Circle engage in personality development and motivation sessions. The idea is to channel employee work potential in the right direction. They try to improve themselves and use their group expertise as a problem-solving tool. They also pressure the management to get a task done. Though they receive no financial rewards, their expertise and effort gets duly acknowledged.

Quality Circles – Must receive support from the management

Not all Japanese Quality Circles that were started are in operation today. In short, just setting up Quality Circles is not enough. They need top management support to survive and foster. However, over the years, Japan has seen more than 10 million Quality Circle members. That's the popularity of Quality Circles in Japan!

Quality Circles were not created for social gatherings. They have largely aimed at putting Japan's name on the industrial world map. Moreover, they assist employees in resolving their problems and improving organization performance.

Simply put a Quality Circle is a forum where employees

- Can resolve their problems.
- Generate greater operational and commercial awareness.
- Focus on continuous improving.

Conclusion

Ishikawa's pioneering work in the field of quality is available in the form of concepts like the Cause and Effect Diagram and his views on CWQC. What he proposed nearly 50 years ago is still widely used as problem-solving tools.