

## New Tools of Quality Management (Seven New Q.C Tools)



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## Seven New Tools of Quality Management

- Affinity Diagram (KJ method)
- Relationship Diagram
- Tree Diagram
- Process Decision Program Charts (PDPC method)
- Matrix Diagram
- Matrix Data Analysis
- Arrow Diagram

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## Seven New Tools

- Committee set up by Japanese Union of Scientists and Engineers (JUSE) - 1972
  - Aim: to develop more QC techniques with design approach
- Work in conjunction with original Basic Seven Tools
- Developed to organize verbal data diagrammatically.
- Identified in 1988
  - book: „Management for Quality Improvement” by Shigeru Mizuno

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## AFFINITY DIAGRAM

- Also named **KJ method**
  - author: Jiro Kawakito
- Gathers large amounts of verbal data (ideas, opinions, issues) and organizes them on the basis of the intuitive relationship (affinity) into groups and subgroups .
  - Organization based on natural relationships
  - This makes it feasible for further analysis and to find a solution to the problem.

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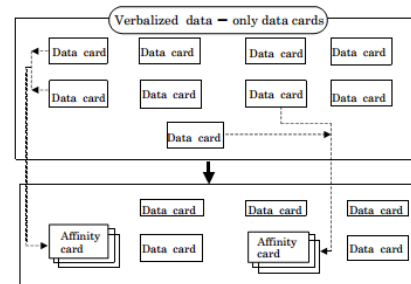
## When to Use?

- When you are confronted with many facts or ideas in apparent chaos
- When issues seem too large and complex to grasp (understanding)
- When group consensus is necessary

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## Affinity Diagram Example



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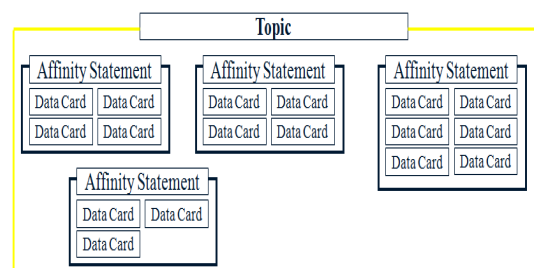
## Procedure

1. **Determine the theme.**
2. **Collect factual data for the determined theme.**
  - Brainstorming.
3. **Write the above verbal information onto cards**
  - one piece of information per card.
4. **Organize data cards into groups of similar themes (natural affinity)**
  - Look for ideas that seem to be related
  - Sort cards into groups until all cards have been used.
5. **Name each group**

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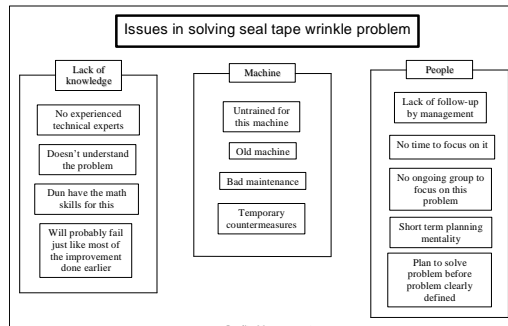
## Affinity Diagram Sample - Final result



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## Affinity Diagram Example 1



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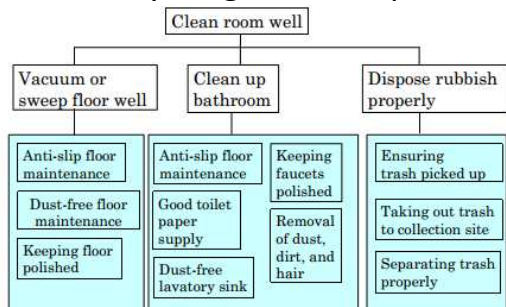
## RELATIONSHIP DIAGRAM

- Also known as **INTER-RELATIONSHIP DIAGRAM**
- Used to depict the relationship between different issues
- Helps to untangle and find logical relations among complex intertwined causes and effects
- Allows for multidirectional thinking rather than lateral thinking

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## Affinity Diagram Example 2



Noriharu Kaneko

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## When to Use?

- When trying to understand links between ideas or cause-and-effect relationships, such as when trying to identify an area of greatest impact for improvement.
- When a complex issue and solution is being analyzed and implemented for causes.
- After generating an affinity diagram, cause-and-effect diagram or tree diagram, to more completely explore the relations of ideas.

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## Procedure

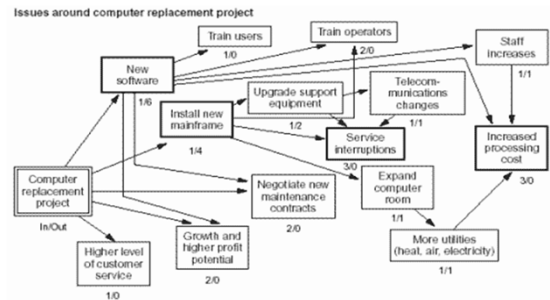
1. Express the problem
2. List the causes affecting the problem
  - Write each item on a card
3. Explore the cause-effect relationships, and divide the cards into primary, secondary and tertiary causes
4. Connect all cards by these relationships
5. Review whole diagram looking for relationships among causes

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## Example

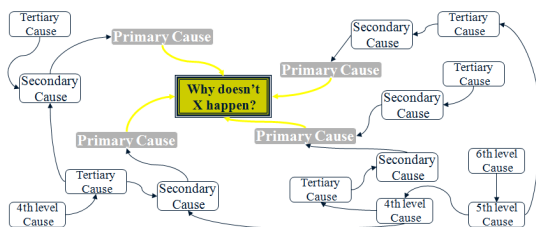
A computer support group is planning a major project: replacing the mainframe computer



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## A Sample Relationship Diagram



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## TREE DIAGRAM

- Systemical diagram
- or
- Tree analysis
- or
- Analytical tree
- or
- Hierarchy diagram
- or
- Why-why? diagram

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## TREE DIAGRAM

- It looks like a tree, with trunk and multiple branches.
- It is used to break down broad categories into finer and finer levels of detail. Developing the tree diagram helps you move your thinking step by step from generalities to specifics.

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## Procedure

1. Determine the main goal
2. Brainstorm the main tasks involved in solving the problem and add them to the tree
  - be concise
3. Brainstorm subtask that can also be added to the tree
4. Do this until all possibilities have been exhausted

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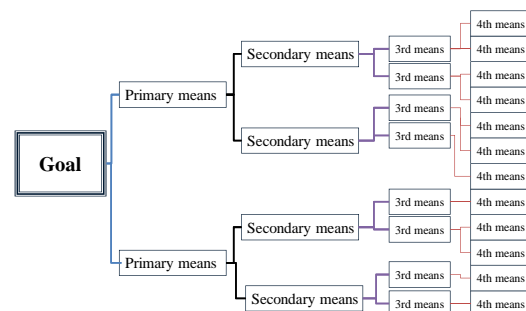
## When to use a tree diagram

- When an issue is known or being addressed in broad generalities and you must move to specific details.
- When developing actions to carry out a solution or other plan.
- When analyzing processes in detail.
- When probing for the root cause of a problem.
- When evaluating implementation issues for several potential solutions.
- After an affinity diagram or relations diagram has uncovered key issues.
- As a communication tool, to explain details to others.

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## Example

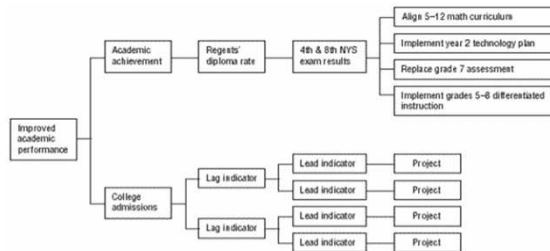


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### Example

The Pearl River, NY School District, a 2001 recipient of the Malcolm Baldrige National Quality Award, uses a tree diagram to communicate how district-wide goals are translated into sub-goals and individual projects



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### Procedure

1. Define the aim
  - You can use the result of tree diagram or a list of the steps in the process you wish to analyze
2. List what could go wrong at each step
3. List the counter-measures to the problems
4. Evaluate the counter measures by placing an O for feasible or an X for not feasible

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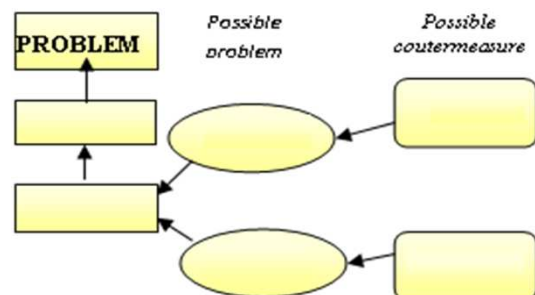
### PROCESS DECISION PROGRAM CHART (PDPC)

- It is a good tool to use for contingency planning.
- The PDPC systematically identifies what might go wrong in a plan under development.
- Countermeasures are developed to prevent or offset those problems.

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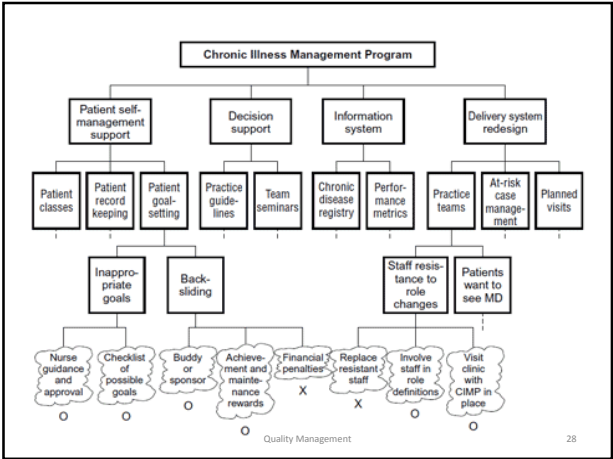
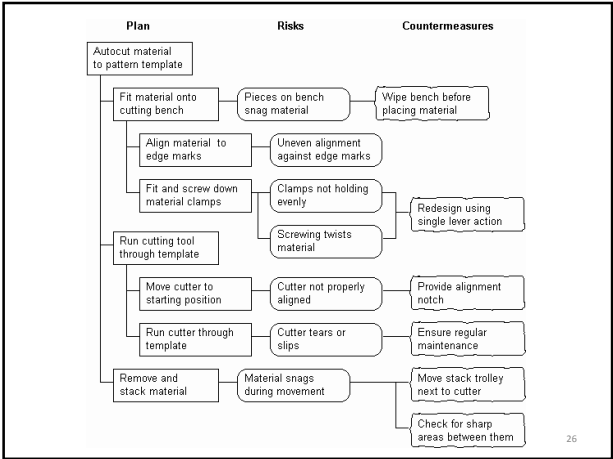
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### Sample



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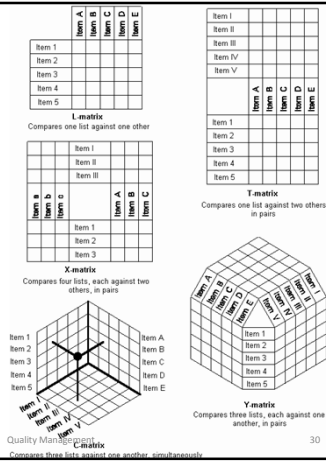
Example

- A medical group is planning to improve the care of patients with chronic illnesses such as diabetes and asthma through a new Chronic Illness Management Program (CIMP).
- They have defined four main elements and, for each of these elements, key components

Matrix Diagram

- Also known as **Matrix chart**
- It shows the relationship between two, three or four groups of information. It also can give information about the relationship, such as its strength, the roles played by various individuals or measurements
- Six differently shaped matrices are possible: L, T, Y, X, C, R and roof-shaped, depending on how many groups must be compared.

## TYPES OF MATRICES



- A **C-shaped matrix** relates three groups of items all together simultaneously, in 3-D.
- An **X-shaped matrix** relates four groups of items. Each group is related to two others in a circular fashion.
- A **roof-shaped matrix** relates one group of items to itself. It is usually used along with an L- or T-shaped matrix. (Used in QFD)

## When do we use each Shape

- An **L-shaped matrix** relates two groups of items to each other (or one group to itself).
- A **T-shaped matrix** relates three groups of items: groups B and C are each related to A. Groups B and C are not related to each other.
- A **Y-shaped matrix** relates three groups of items. Each group is related to the other two in a circular fashion.

## Procedure

1. Select factors
2. Select type of matrix
3. Select the symbols for relationships
4. Fill in the matrix
5. Analyze and make conclusions



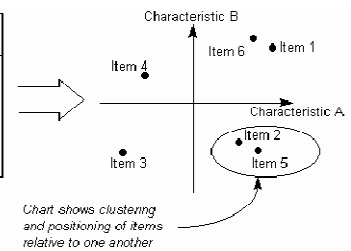
## MATRIX DATA ANALYSIS

- Also known as: **Matrix Data Analysis Chart (MDAC)**
- One of the most rigorous, careful and time-consuming of decision-making tools
- It is an L-shaped matrix that uses pair-wise comparisons of a list of options to a set of criteria in order to choose the best option(s).
- Based solely on numerical data

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Measured Item	Characteristic A	Characteristic B
Item 1	10	8
Item 2	5	-4
Item 3	9	5
Item 4	-5	3
Item 5	7	-5
Item 6	8	9



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## When to use it

- When investigating factors which affect a number of different items, to determine common relationships.
- To determine whether or not logically similar items also have similar factor effects.
- To find groups of logically different items which have similar factor effects.

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## Procedure

1. Identify your goal
2. Collect needed data and present them in a matrix
3. Based on the collected data calculate the two evaluated parameters
4. Plot the result on graph

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Example  
**A toy store**

(source: [http://www.syque.com/quality\\_tools/toolbook/MDAC/example.htm](http://www.syque.com/quality_tools/toolbook/MDAC/example.htm))

- **Aim:** to increase sales while improving the satisfaction of its customers with the toys that it sold.
- **Measure:**
  - the initial appeal (which related to actual purchase) and the longer term satisfaction (which related to company image)
  - a range of toys for boys aged 5 to 10, both being scored on a one-to-ten scale
- Identify the best toys to promote and to find possible ways of improving other toys

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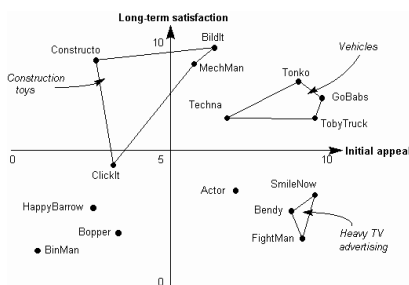
### ARROW DIAGRAM

- Activity Network Diagram
- or
- Network Diagram
- or
- Activity Chart
- or
- Node Diagram
- or
- CPM (Critical Path Method) Chart

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Example  
A toy store



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### ARROW DIAGRAM

- Used to plan the implementation of complex undertaking (project)
- Shows the required order of tasks in a project or process, the best schedule for the entire project, and potential scheduling and resource problems and their solutions.
- When scheduling and monitoring tasks within a complex project or process with interrelated tasks and resources.

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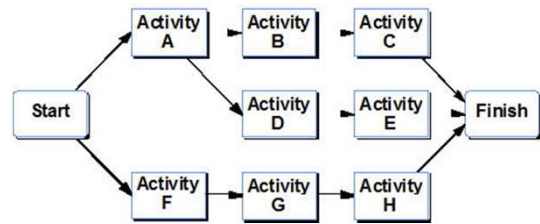
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## When to use

- When you know the steps of the project or process, their sequence and how long each task.
- When project schedule is critical, with serious consequences for completing the project late or significant advantage to completing the project early.

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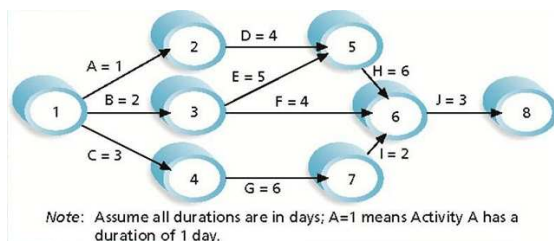


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## Arrow Diagram

- Activities are represented by arrows



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## Procedure

- **Define the proposed project (process)**
  - determine the beginning and end of project)
- **Define a list of actions necessary to proceed with the project (process)**
- **Estimate duration of the individual steps**
- **Define the order of the steps**
- **Draw a diagram**
- **Analyze the diagram**
  - The designation of the critical path (longest path in the network, which determines the shortest possible time of completion of the project, in which there are critical steps, ie those that have no slack time)
  - Calculate the time needed to complete the entire project

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