

# **New Quality Tools**

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# The Seven New Quality Tools

- Affinity Diagrams
- Interrelationship Diagrams
- Tree Diagrams
- Matrix Diagrams
- Matrix Data Analysis
- Process Decision Program Charts
- Arrow Diagrams

# Relations to “Old” Tools

- Similarities:
  - Both are graphics rather than language based
    - Whole first, then elements analyzed
    - Universal understanding (pictures)
- Differences:
  - New tools are more relational and network oriented
  - New tools may take more practice to develop proficiency
- They can and should be used together

# Affinity Diagrams

- Organizes a large amount of verbal data related to a broad problem or subject
  - Ideas, opinions, facts
- Usage example: Establishing a new QC policy
- Steps:
  - Gather a large number of ideas
  - Put individual ideas on cards or sticky notes
  - As a team, group the ideas according to natural “affinity” or relationship to each other
  - These natural groups become “strategic factors”

# Affinity Diagram Example

Your team has been brainstorming to develop a list of ideas to incorporate into the vision. They have come up with the following list. Develop an affinity diagram and name each strategic factor.

- Low product maintenance
- Satisfied employees
- Courteous order entry
- Low prices
- Quick delivery
- Growth in shareholder value
- Teamwork
- Responsive technical support
- Personal employee growth
- Low production costs
- Innovative product features
- High return on investment
- Constant technology innovation
- High quality
- Motivated employees
- Unique products
- Small, lightweight designs



# Interrelationship Diagrams

- Identifies and explores causal relationships among related concepts or ideas. Can address problems with a complex network of causes and effects.
  - Identifies key drivers and bottlenecks
- Usage examples: design steps to counter market complaints, or reform administrative departments
- Steps:
  - Write each concept or idea on a piece of paper in a circular pattern (allow room between concepts)
  - Number them to make comparison process easier to track
  - Use pairwise comparisons (1-2, 1-3, 1-4...2-3, 2,4...3,4)
    - If there is a relationship draw arrow to effect
    - If there is no relationship leave blank
    - There can be no 2-way relationships

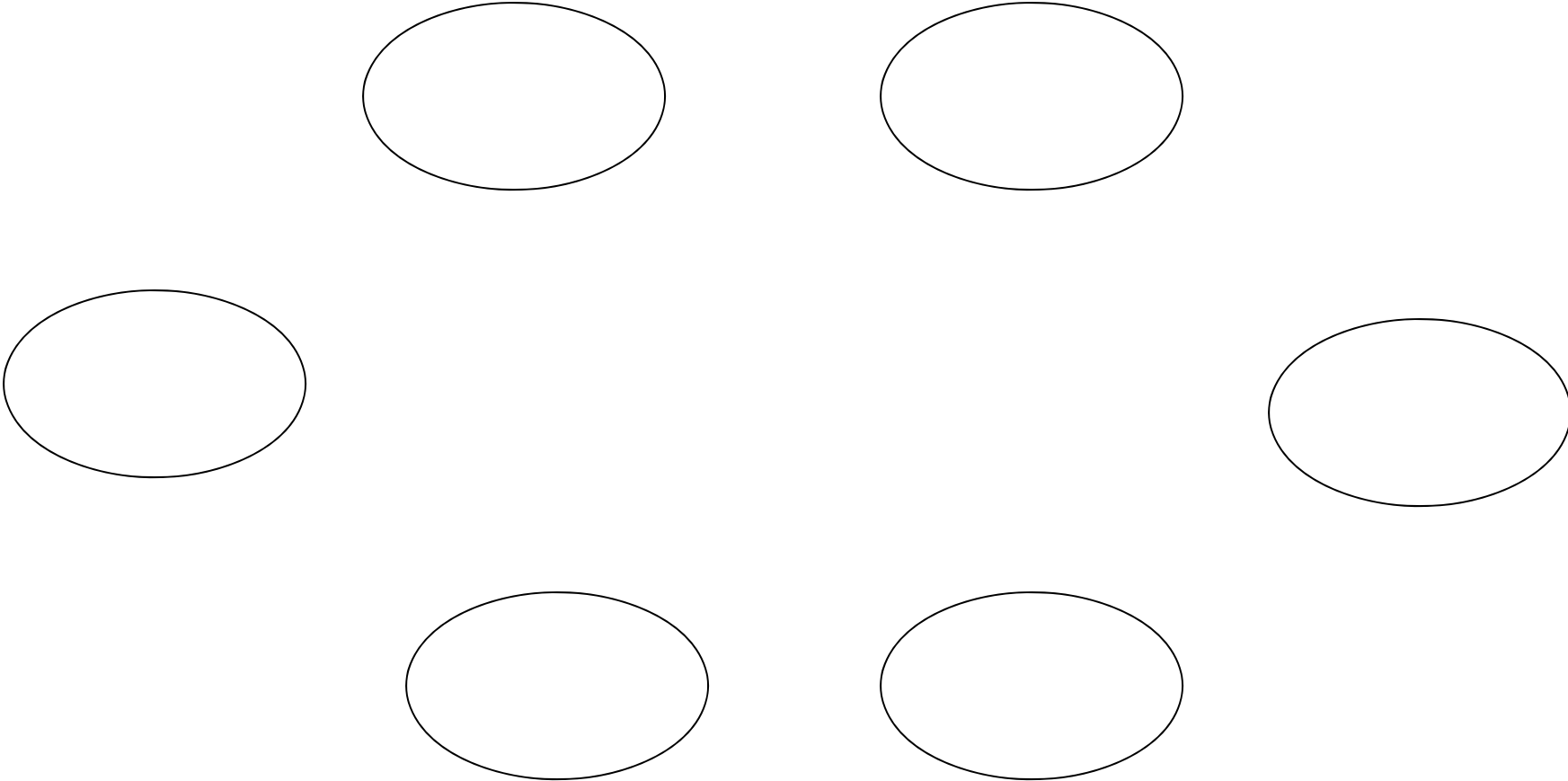
# Interrelationship Diagrams Cont.

- Steps (Cont.)
  - Analyze the diagram
    - Count the arrows (# out - # in)
      - Highest out are primary drivers
        - » Resources here can produce pronounced change
      - Lowest are key bottlenecks
        - » Affected by many other options
        - » May be inhibiting other options from proceeding as required
    - Highlight primary drivers and key bottlenecks
- Note: examine only cause and effect relationships. Likely will have arrows on only 50% of relationships.

# Interrelationship Diagram Example

- Use the strategic factors derived from your affinity diagram to develop an interrelationship diagram. If you were unsuccessful in developing your own strategic factors use the following:
  - Customer Value
  - Work Environment
  - Customer Service
  - ROI
  - Technology
  - Product Innovation

# Interrelationship Diagram Example Cont.



# Tree Diagrams

- Expands a purpose into the tasks required to accomplish it.
- Usage examples: deploy a quality plan, or develop objectives, policies and implementation steps.

# Tree Diagrams (cont.)

- Steps:
  - Work from left to right
  - Start with the purpose to be accomplished
  - Generate the high level targets or goals that must be completed to accomplish the purpose
  - Link each goal to the purpose (these are the first branches of the tree)
  - Expand on each target to identify and define subordinate tasks to accomplish each target
  - Link each to their target
  - Continue expansion process until final level is implementable.
  - Review logic of completed tree (perhaps with larger group)

# Tree Diagram Example

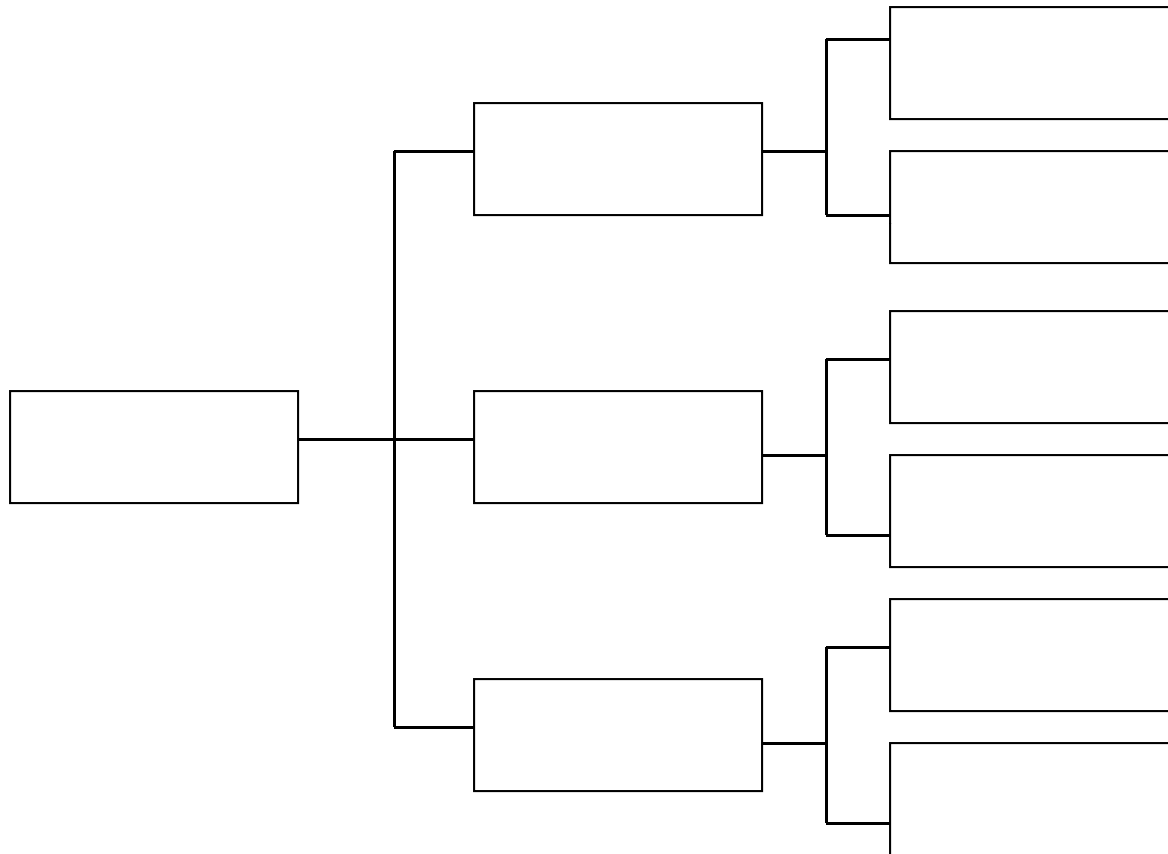
- Refer to the key strategic factors (primary driver or key bottleneck) identified from your interrelationship diagram – this will be your purpose. Refer to ideas associated with that factor on your affinity diagram – these will be your primary target or goals. Develop a tree diagram including this information, and expand it into several next level strategies to meet these targets.
- If you are unable to gather the required information, use “Customer Service” as your purpose, and “improving the order entry process”, “reducing delivery time” and “improving technical support” as your primary goals.

# Tree Diagram Example Cont.

**Key Strategic Factor**

**Goals**

**Strategies**



# Matrix Diagrams

- S.M.A.R.T. Plan Matrices
  - Technique for structuring the task details when planning the implementation of a project.
  - May use the final output of a tree diagram
  - For each implementable task:
    - Specific (activity or task)
    - Measurable (outcome or process)
    - Assignment (who will perform)
    - Resources (what is needed)
    - Time (anticipated duration)
    - Predecessors (what must be done first)
  - Consensus should be reached among all parties on the SMART matrix
- Correlation Matrices
  - Shows the relationship between one list of variables and another. Relationships are usually based on experience.
  - Such a matrix forms the body of a “house of quality”

# Matrix Diagrams

## Correlation Matrix

### Example

- = Strong relationship
- = Medium relationship
- △ = Weak relationship

Actions Goals	Improve Work Environment	Improve Manufacturing Technology	Develop New Products
Cost Effectiveness	●	○	
High Quality	●	●	
Shareholder Value		△	●

# Matrix Diagram S.M.A.R.T. Plan Example

	Specific	Measurable	Assignment	Resources	Time (Weeks)	Predecessors
A	Evaluate Needs	Deliverable	Steve	8 hours	1	-
B	Schedule Training	Deliverable	Doug	4 hours	1	-
C	Evaluate Software	Deliverable	Morgan	10 hrs, copies of software	2	A
D	Training Materials	Deliverable	Doug	20 hrs, software manuals	3	C
E	Purchase	Deliverable	Ted	2 hours	2	C
F	Install	# systems	Ted	50 hours	2	E
G	Train Users	# trained	Doug	20 hours	1	B, D, F

# Matrix Data Analysis

- Arranges a large array of numbers so that they may be visualized and comprehended easily
- Usage example: evaluate the desired quality level from the results of a market survey
- Steps:
  - Begin with numerical matrix relating goals or requirements to actions or performance
  - Assign weights to each goal or requirement
    - Subjective
    - Objective (principle component analysis)
  - Calculate weighted importance of actions or performance level

# Matrix Data Analysis Example

Requirement	Importance Weight	Best Competitor Evaluation	Own Evaluation	Weighted Gap
Price	.2	6	7	
Speed of Delivery	.3	7	6	
Reliability	.4	5	6	
Customizability	.1	8	7	

# Process Decision Program Charts

- Maps out all contingencies when moving from statement of purpose to its realization
- Usage example: establishing an implementation plan for improvement project
- Steps:
  - Another form of a tree diagram
  - First level: purpose
  - Second level: activities to be undertaken
  - Third level: steps in these activities
  - Fourth level: what ifs? (contingencies)
  - Fifth level: countermeasures (contingency plans)

# Process Decision Program Chart Example

- Choose one of the strategies that you came up with in your tree diagram. Expand on the actions necessary to implement this strategy. Select one action and expand on the necessary steps. Continue expanding along a single branch until you can develop at least one contingency and possible countermeasure.

# Arrow Diagrams

- Also utilized by PERT and CPM, establishes the most suitable daily plan. It is a network of lines that connects all of the elements related to plan execution.
- Steps: (working on the nodes)
  - All of your activities that have no predecessors can be placed along the left of the page
  - Activities that immediately follow are drawn to the right of the first activities
  - Arrows are drawn from each activity to all those activities that immediately follow that activity
  - Continue adding activities until the process is finished
  - Time estimates can be easily added to schedule and control the project

# Arrow Diagram Example

- Use the SMART matrix example above to create an arrow diagram.

# Summarizing Remarks

- The Seven New Tools
  - Display information in intuitively helpful ways
  - Structure group work and discussion
  - Promote non-linear thinking
  - Can become quite sophisticated
  - Can be used with the “old” tools