QUALITY MANAGEMENT
(MSL 71500)
(2 – 0 - 0)

HANDOUT V

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THE SEVEN MANAGEMENT TOOLS

a) Affinity diagram

What is it?

This is a tool used to categorize verbal data about previously unexplored issues, problems and themes that are hazy, uncertain, complex and difficult to understand thereby helping to create order out of chaos.

An affinity diagram is a tool to group a large amount of ideas generated by means of brainstorming. It may also be used in conjunction with or as an alternative to brainstorming and are useful when new thoughts and ideas are needed.

When do you use it?

An affinity diagram is used on the one hand to group a large amount of ideas based on existing relationships between these ideas, and on the other hand to stimulate creativity and teamwork during the brainstorming process.

How do you use it?

1. Problem formulation. Write down the problem formulation on a black board or flip-chart in such a way, that it is visible to everyone.

2. The facilitator should allow everyone to formulate their ideas in random order and to write them down on a yellow (post-it) note.

3. When all the ideas/notes have been placed on the board, all team members should come in front to group or categorize the notes around certain themes without discussion or comments. Group the notes by assumed associations and limit these to ten. In case a note is not in the right place, move it.

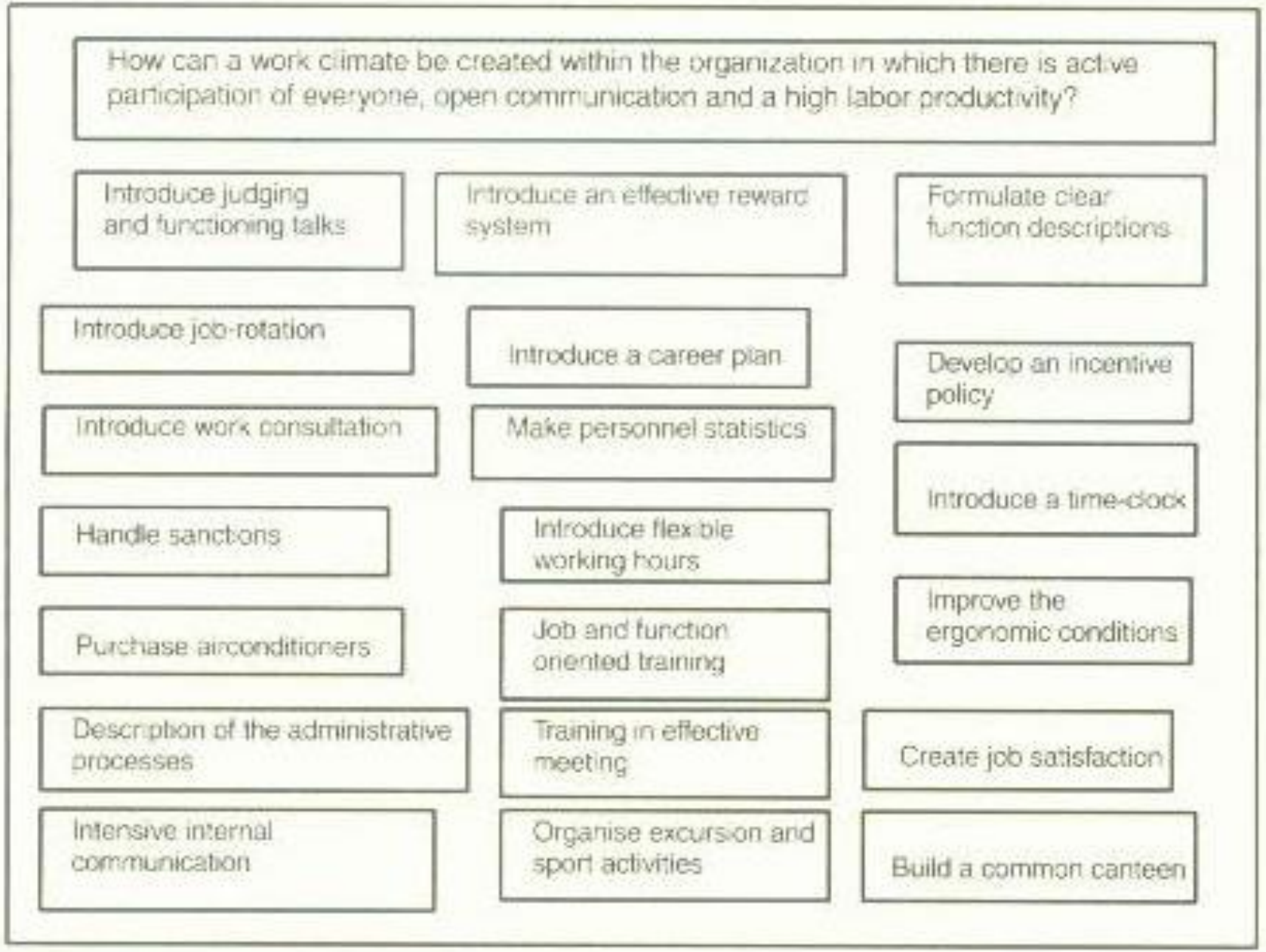
4. Place a header above each cluster of notes.

Example:

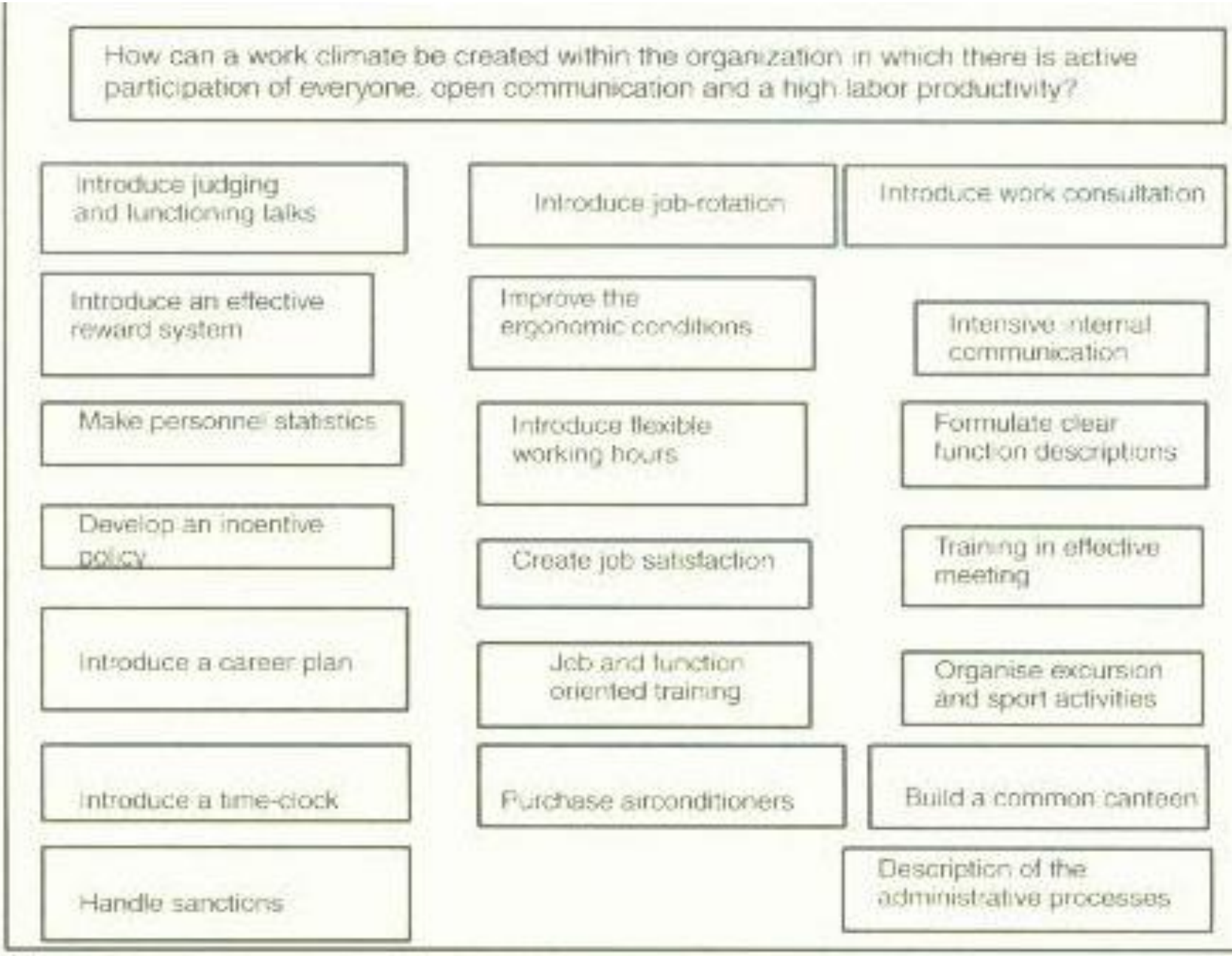
To improve the motivation and labor productivity of the employees, the management of a company organized a brainstorming session using the affinity diagram.

A) An improvement team was put together which formulated the following problem: *"How can a work climate be created within the organization in which there is active participation of everyone, open communication and a high labor productivity?“*

B) On the basis of the already mentioned brainstorming rules, the team members generated some ideas, whereby each idea was written on a yellow (post-it) note, and placed in random order on the board. This board is shown in the figure.


How can a work climate be created within the organization in which there is active participation of everyone, open communication and a high labor productivity?
Introduce judging and functioning talks
Introduce an effective reward system
Formulate clear function descriptions
Introduce job-rotation
Introduce a career plan
Develop an incentive policy
Introduce work consultation
Make personnel statistics
Introduce a time-clock
Handle sanctions
Introduce flexible working hours
Improve the ergonomic conditions
Purchase airconditioners
Job and function oriented training
Description of the administrative processes
Training in effective meeting
Create job satisfaction
Intensive internal communication
Organise excursion and sport activities
Build a common canteen

C) Next, all participants were called to the front and they clustered the notes without discussions or comments (see figure).
They also moved the incorrectly placed notes.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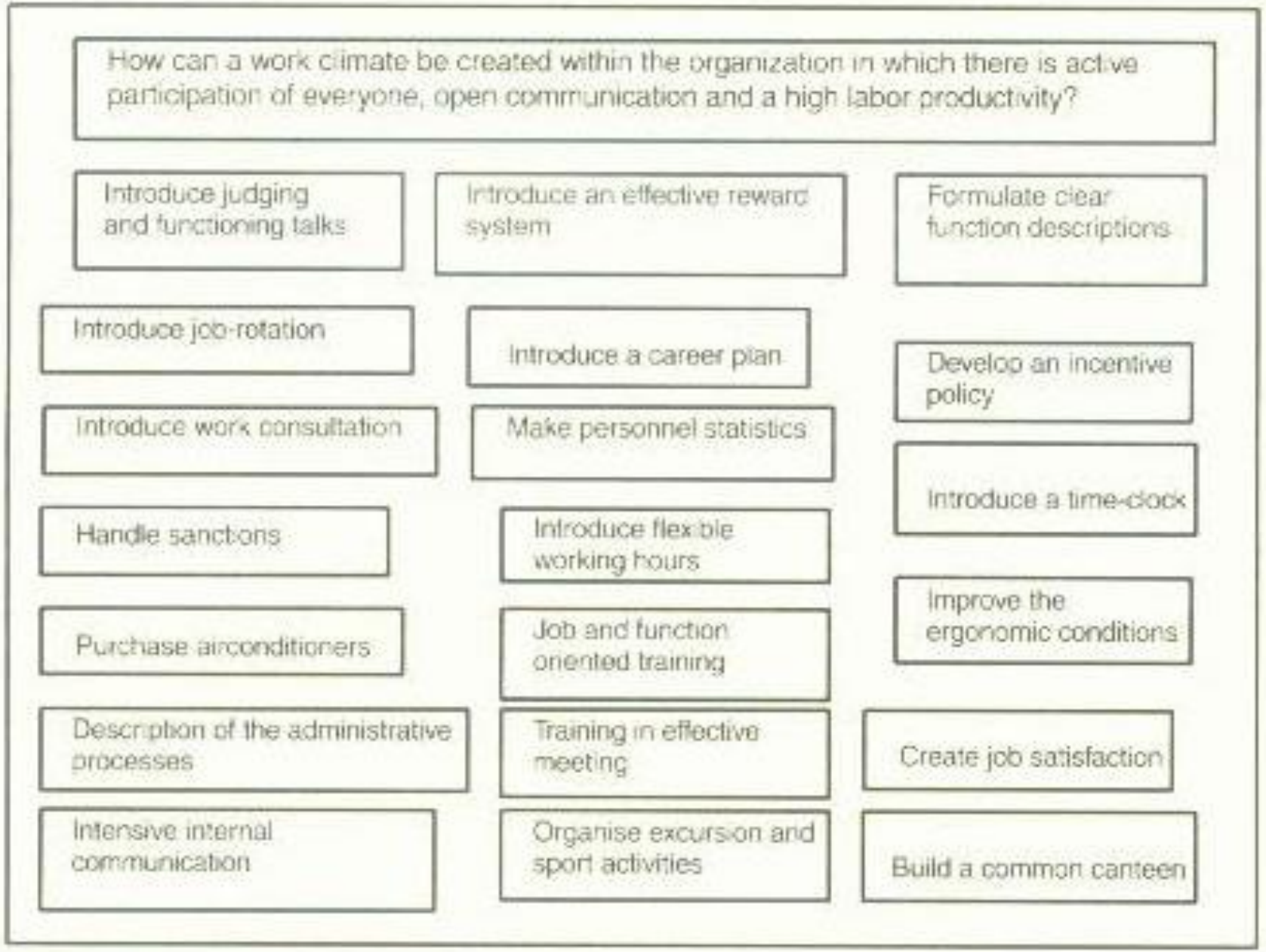
Introduce a time-clock
Purchase airconditioners
Build a common canteen
Handle sanctions
Description of the administrative processes

D) The previous step resulted in the following clusters of ideas:
• judging/remuneration;
• working conditions;
• communication.

A header was placed above each cluster of notes.For each cluster a group was then put together which arranged the ideas according to their priority. The ideas with the highest priority were worked out more accurately by the groups concerned and then reported to the management.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b) Arrow diagram/critical path analysis:

What is it:
This is a tool that applies systematic thinking to the planning and execution of a complex set of tasks.

It is used to establish the most suitable plan for a series of activities in a project, and to monitor its progress in an efficient manner to ensure adherence to the schedule.

Arrow diagrams are necessary to describe the interrelationships and dependencies of tasks within a complex job or project.

When do you use it?

They are deployed at the implementation planning stage of a project, which is always the critical stage. The sequence of the steps involved and their relation to each other are indicted by arrows and in this way a network of activities is developed.

The technique is used in project management in relation to critical path analysis (CPA) and the programme evaluation and review technique (PERT).

How do you use it?

Steps for drafting an arrow diagram:

1.Identify all activities needed to complete the plan.

2.The beginning or end of an activity or group of activities is called an event or node, and these are represented as circles.

3. Decide the feasible sequence of the activities:

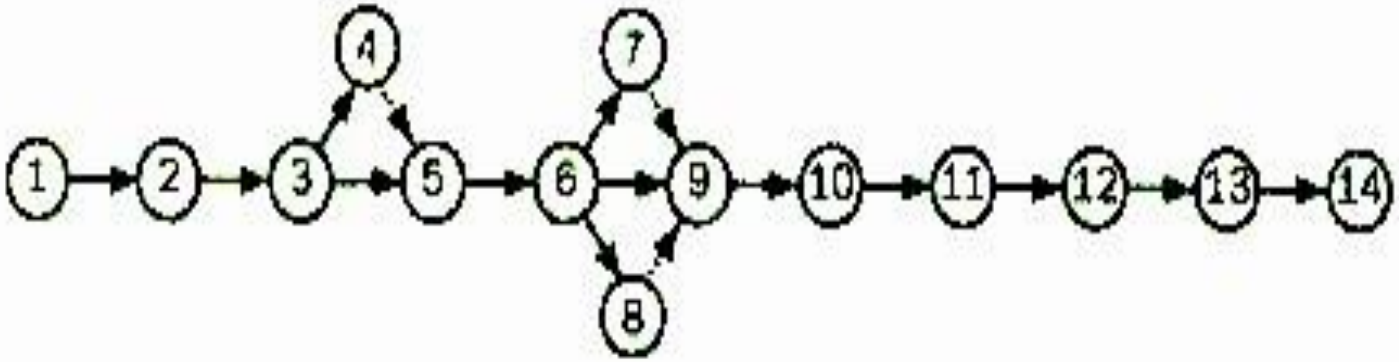
- which activities must precede certain activities (predecessor activities)
- which activities must follow an activity (consecutive activities)
- which activities can be done at the same time (concurrent or parallel activities)

4. Arrange the diagram from left to right according to the above logic with each activity represented by an arrow.

5. The beginning or end of an activity or a group of activities is called an event or node, and these are represented as circles at the tail and head of an arrow. The events should be numbered in the order in which activities occur.

6.The time required for each activity is indicated under the appropriate arrow.

7. Analyse the network to find the critical path and to establish in which activities there is free time (float). This is achieved by determining the earliest and latest event times.



Activities

1-2 Choose locations

2-3 Assign responsibilities

3-4 Determine size and configuration of displays needed

3-5 Consider health and safety implications of potential locations

5-6 Establish public relations departments' stock of displays and their availability

6-7 Determine method of display (free-standing/wall-mounted)

6-8 Determined preferred 'editorial content' of displays

6-9 Action update of display contents

7-9 Obtain costings for additional/alternative displays

9-10 Source initial display items (e.g. graphs, photographs, successes)

10-11 Agree format and action the 'design a logo' competition

11-12 Arrange for displays to be sited/ mounted

12-13 Review cost implications

13-14 Seek verbal feedback from site employees

c) Matrix diagram

What is it:

Matrix diagrams are tools used to clarify the relationship and key connecting points between results and causes or between objectives and methods and to indicate their relative importance.

They are also useful for drawing conclusions between consequences and their causes.

There are atleast 5 standard formats: L-shaped (2 variables), T-shaped (3 variables), Y-shaped (3 variables), C-shaped (3 variables) and X-shaped (4 variables). L-shaped format is the most common.

When do you use it?

They are used when there are two sets of factors and methods, which may or may not have any relationship with each other. Symbols are used to depict the presence and strength of a relationship between sets of data.

How do you use it?

1. Decide the characteristics, tasks, problems, causes, methods, measures etc. to be compared, mapped and displayed.

2. Decide how to arrange the problems and their causes.

3. Define and specify the symbols that are to be used to summarize a relationship.

4. The relationships between, say, the needs and features or problems and causes etc. are identified and discussed and symbols used to indicate the strength of the relationship where a column and a row intersect.

5. Review the completed diagram for accuracy.

Use / Tool	Creativity	Analysis	Consensus	Action
Affinity diagram	○		○	△
Interrelationship digraph		○	◎	
Tree diagram		◎		◎
Prioritization matrix			○	
Matrix diagram		○	◎	○
PDPC	◎	◎	◎	○
Activity network diagram			◎	○

Legend: Always ○ Frequently ◎ Occasionally △

d) Process decision programme chart:

What is it?
Programs to achieve particular objectives do not always go according to plan, and unexpected developments may have serious consequences. The process decision program chart (PDPC) is a tool that avoids surprises and identifies possible counter-measures.

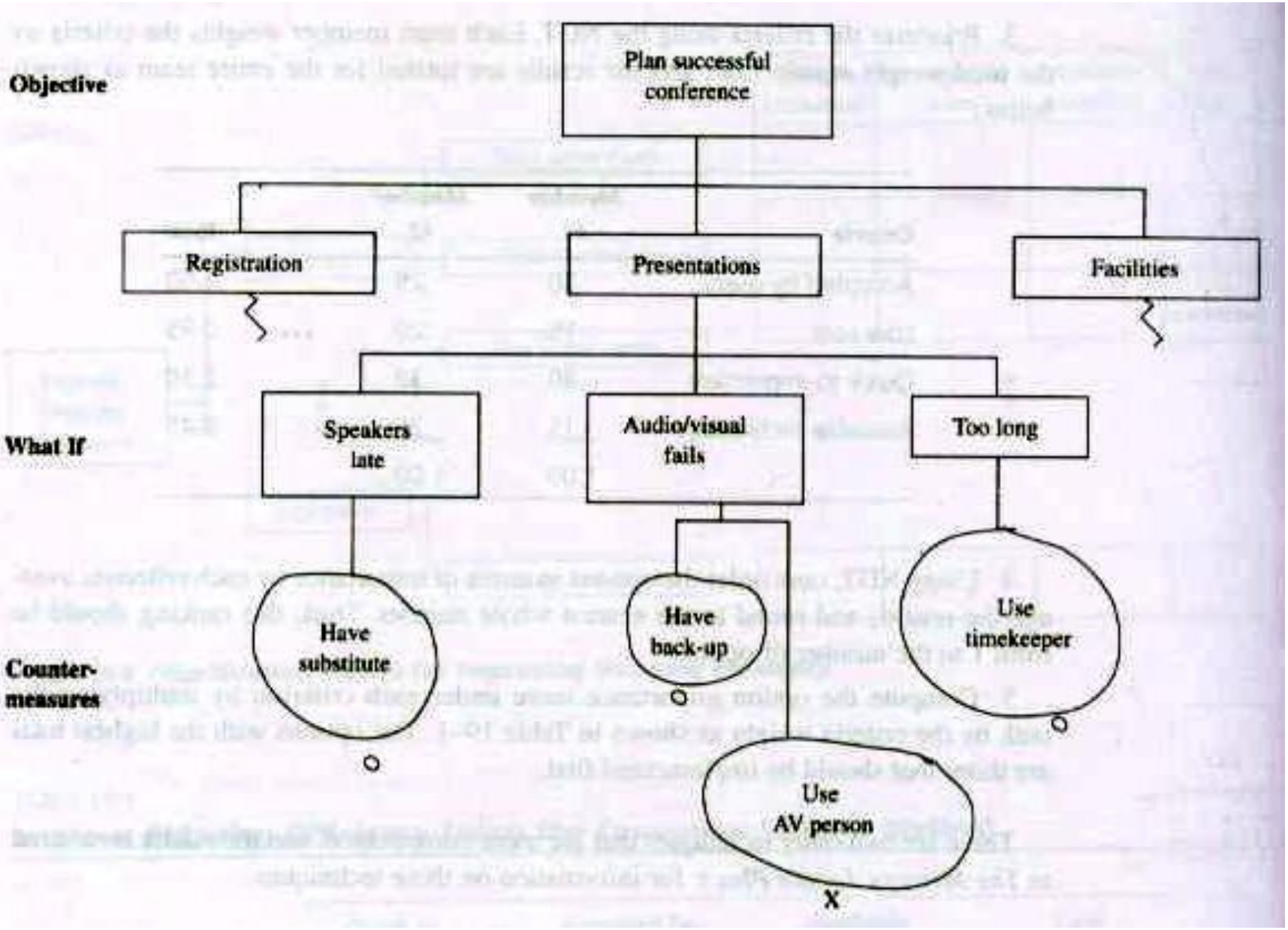
When do you use it?
It is used when the situation is such that unexpected developments may occur and have serious consequences.

How do you use it?
1.The procedure starts with the team stating the objective, which is to plan a successful conference.
2. That activity is followed by the first level, which is the conference activities of registration, presentations, and facilities.
3. In some cases a second level of detailed activities may be used.

4. Next, the team brainstorms to determine what could go wrong with the conference, and these are shown as the "what-if" level.

5. Countermeasures are brainstormed and placed in a balloon in the last level.

6. The last step is to evaluate the countermeasures and select the optimal ones by placing an *0* underneath. Place an *X* under those that are rejected.


Objective
Plan successful conference
Registration
Presentations
Facilities
What If
Speakers late
Audio/visual fails
Too long
Counter-measures
Have substitute
Have back-up
Use timekeeper
Use AV person
X

e) Relations diagram:

What is it?
Relations diagrams are tools used to identify, understand and clarify complex cause and effect relationships to find the causes and solutions to a problem and to determine the key factors in the situation under study. They are also employed to identify the key issues to some desired result.

When do you use it?
Relations diagrams are used when the causes are non-hierarchical and when there are multiple interrelated problems.
Relations diagrams can be considered to be a freer and broader version of a cause and effect diagram.

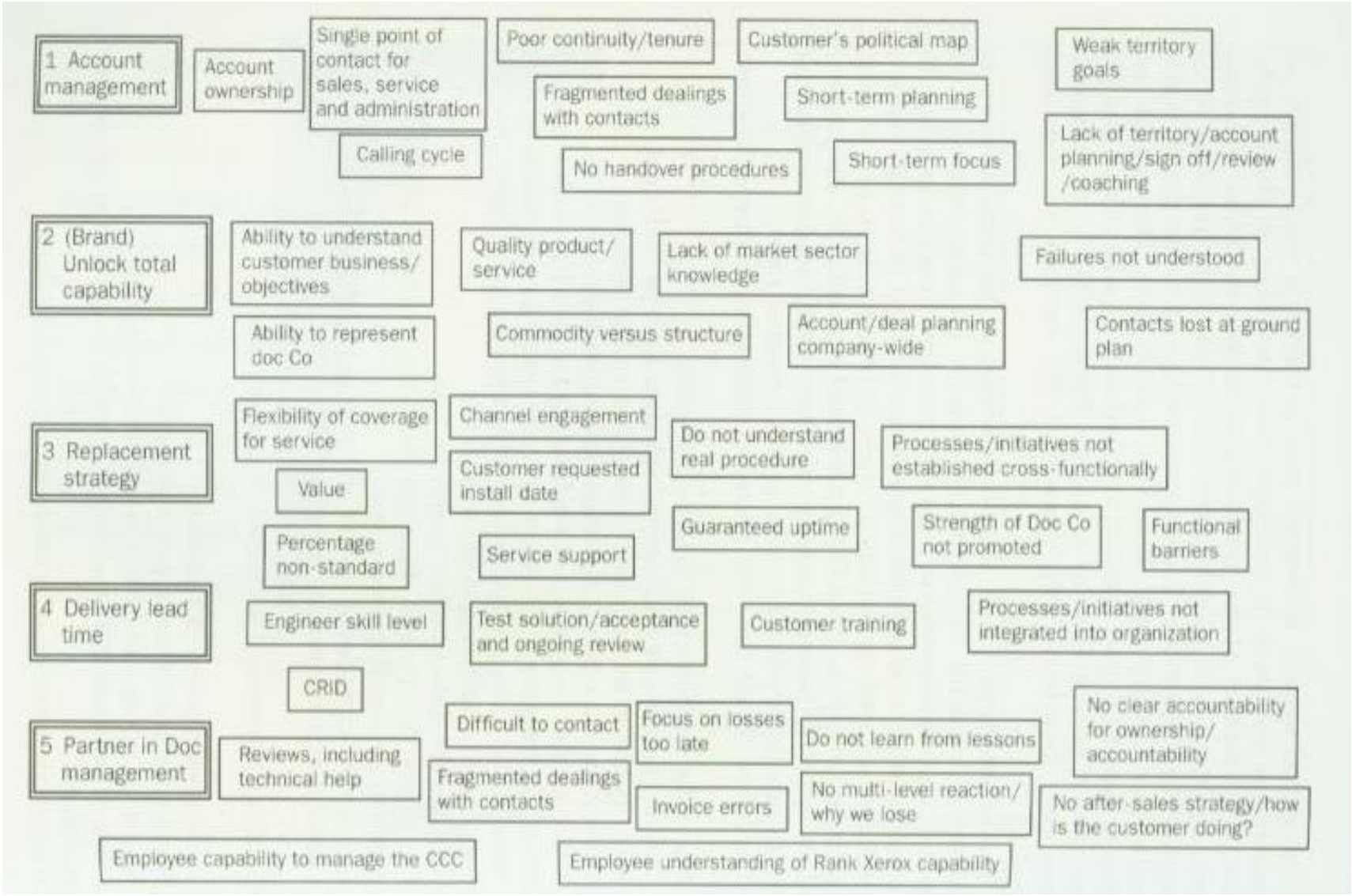
How do you use it?

1) The central problem or issue to be discussed is described clearly and accepted by those concerned. Issues, causes and related problems that are believed to be affecting the central problem(s) are identified. These are written, in summary form, on cards, one issue, cause or problem per card.

2) The cards are then placed around the central problem/issue in a cause and effect relationship. This is done by placing the card believed to have the strongest relationship closest to the central problem/issue; other cards are ranked accordingly.

3) The cause and effect cards are enclosed within rectangles or ovals, and arrows are used to highlight which causes and effects are related. The relationship is indicated by arrows pointing from cause to effect. The key cause and effects are emphasized by double lines, shading etc.

4) Appropriate revisions are made to the diagram. The resulting diagram is analysed for principle causes.


1 Account management
Account ownership
Single point of contact for sales, service and administration
Calling cycle
Poor continuity/tenure
Fragmented dealings with contacts
No handover procedures
Customer's political map
Short-term planning
Short-term focus
Weak territory goals
Lack of territory/account planning/sign off/review /coaching
2 (Brand) Unlock total capability
Ability to understand customer business/ objectives
Ability to represent doc Co
Quality product/ service
Commodity versus structure
Lack of market sector knowledge
Account/deal planning company-wide
Failures not understood
Contacts lost at ground plan
3 Replacement strategy
Flexibility of coverage for service
Value
Percentage non-standard
Channel engagement
Customer requested install date
Service support
Do not understand real procedure
Guaranteed uptime
Processes/initiatives not established cross-functionally
Strength of Doc Co not promoted
Functional barriers
4 Delivery lead time
Engineer skill level
CRID
Test solution/acceptance and ongoing review
Customer training
Processes/initiatives not integrated into organization
5 Partner in Doc management
Reviews, including technical help
Difficult to contact
Fragmented dealings with contacts
Focus on losses too late
Invoice errors
Do not learn from lessons
No multi-level reaction/ why we lose
No clear accountability for ownership/ accountability
No after-sales strategy/how is the customer doing?
Employee capability to manage the CCC
Employee understanding of Rank Xerox capability

f) Systematic diagram/tree diagram:

What is it?
Systematic or tree diagrams are used to examine, in a systematic manner, the most appropriate and effective means of planning to accomplish a task “how to”, or solve a problem (:why”); events are represented in the form of a root and branch relationship.

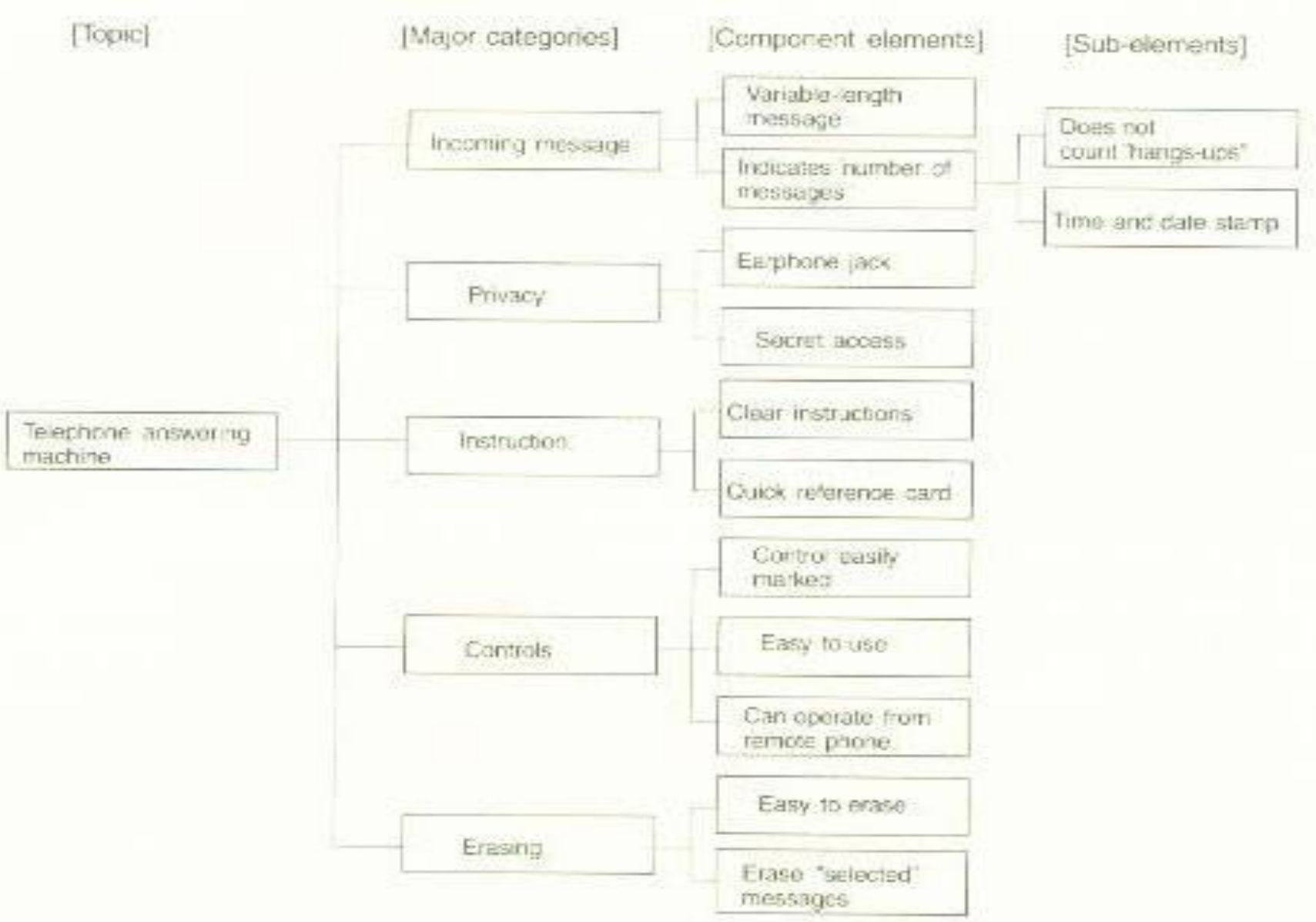
A tree diagram systematically breaks down a topic into its component elements, and shows the logical and sequential links between these elements.

When do you use it?
A tree diagram is used to show the relationships between a topic and its component elements. It is used when the causes that influence the problem are known, but a plan and method for resolving the problem have not been developed.

How do you use it?

Steps for drafting a tree diagram :

1. Clearly and simply state the topic to be studied.
2. Define the major categories of the topic. Brainstorm or use the header cards from the affinity diagram.
3. Construct the diagram by placing the topic in a box on the left-hand-side. Branch the major categories laterally to the right.
4. For each major category, define the component elements and any sub-elements.
5. Laterally branch the component elements and sub-elements for each major category to the right.
6. Review the diagram to ensure that there are no gaps in either sequence or logic.


[Topic]
[Major categories]
[Component elements]
[Sub-elements]
Telephone answering machine
Incoming message
Variable-length message
Indicates number of messages
Does not count "hangs-ups"
Time and date stamp
Privacy
Earphone jack
Secret access
Instruction
Clear instructions
Quick reference card
Controls
Control easily marked
Easy to use
Can operate from remote phone
Erasing
Easy to erase
Erase "selected" messages

g) Matrix data analysis:

A complex mathematical technique for analyzing matrices, often replaced by the similar prioritization matrix.

A prioritization matrix is an L-shaped matrix that uses pairwise comparisons of a list of options to a set of criteria in order to choose the best option(s).

https://asq.org/quality-resources/matrix-diagram#L

OTHER TOOLS

Force field analysis:

What is it?

This is a tool based on the concept that any problem is a result of forces acting on it. The negative or restraining forces keep the problem at its current level while the positive or driving forces push the situation toward improvement. The former are the causes of the problem, the latter are potential solutions.

When do you use it?

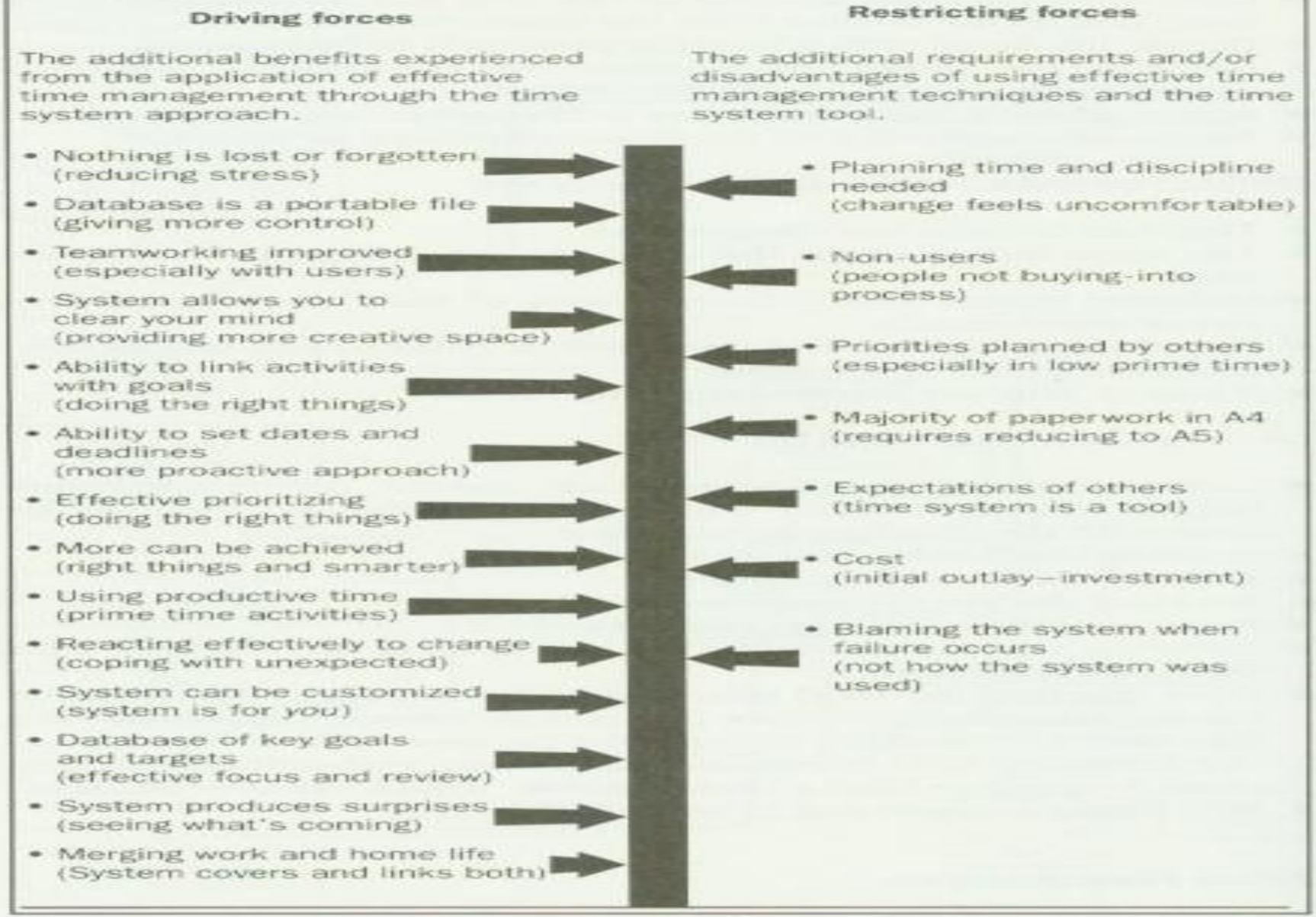
The tool is used to identify forces during the process of change.

How do you use it?

The following are the main steps in constructing a force field diagram:

1. Describe the problem.
2. If the current level of the problem is too high (e.g. rework) the restraining forces will be in a vertical upward position. If the level of the problem is too low (e.g. communication) the restraining forces will be in a vertical downward position.
3. The restraining forces that keep the problem at its current level are first identified. The forces are summarized and connected as a vector to the problem.
4. Once a significant number of restraining forces have been identified, improving or driving forces are pinpointed to counteract each specific restraining force.
5. The completed diagram presents a specific problem together with potential solutions.

Diagram constructed by RHP Newark users after six months application of time management principles using the time system tool.



INTERRELATIONSHIP DIAGRAPH

This diagram clarifies the interrelationship of many factors of a complex situation. It allows the team to classify the cause-and-effect relationships among all the factors so that the key drivers and outcomes can be used to solve the problem.

Procedure:

1. The team should agree on the issue or problem statement.

2. All of the ideas or issues from other techniques or from brainstorming should be laid out, preferably in a circle as shown in Figure 19-2(a).

3. Start with the first issue, "Lack of respect for others" (A), and evaluate the cause-and-effect relationship with "Lack of awareness of impact" (B). In this situation. Issue B is stronger than Issue A; therefore, the arrow is drawn from Issue B to Issue A as shown in Figure 19-2(c), Each issue in the circle is compared to Issue A as shown in Figure 19-2(c), (d), (e). and (f). Only Issues B and E have a relationship with Issue A. The first iteration is complete.

4. The second iteration is to compare Issue B with Issues C, D, E, and F. The third iteration is to compare Issue C with Issues D, E, and F. The fourth iteration is to compare Issue D with Issues E and F. The fifth iteration is to compare Issue E with Issue F.

5. The entire diagram should be reviewed and revised where necessary. It is a good idea to obtain information from other people on upstream and downstream processes.

6. The diagram is completed by tallying the incoming and outgoing arrows and placing this information below the box. Figure 19-3(d) shows a completed diagram.

Issue B is the "driver" because it has zero incoming arrows and five outgoing ones. It is usually the root cause. The issue with the highest incoming arrows is Issue E. It is a meaningful measure of success.

A relationship diagram allows a team to identify root causes from subjective data, systematically explores cause-and-effect relationships, encourages members to think multi-directionally, and develops team harmony and effectiveness.

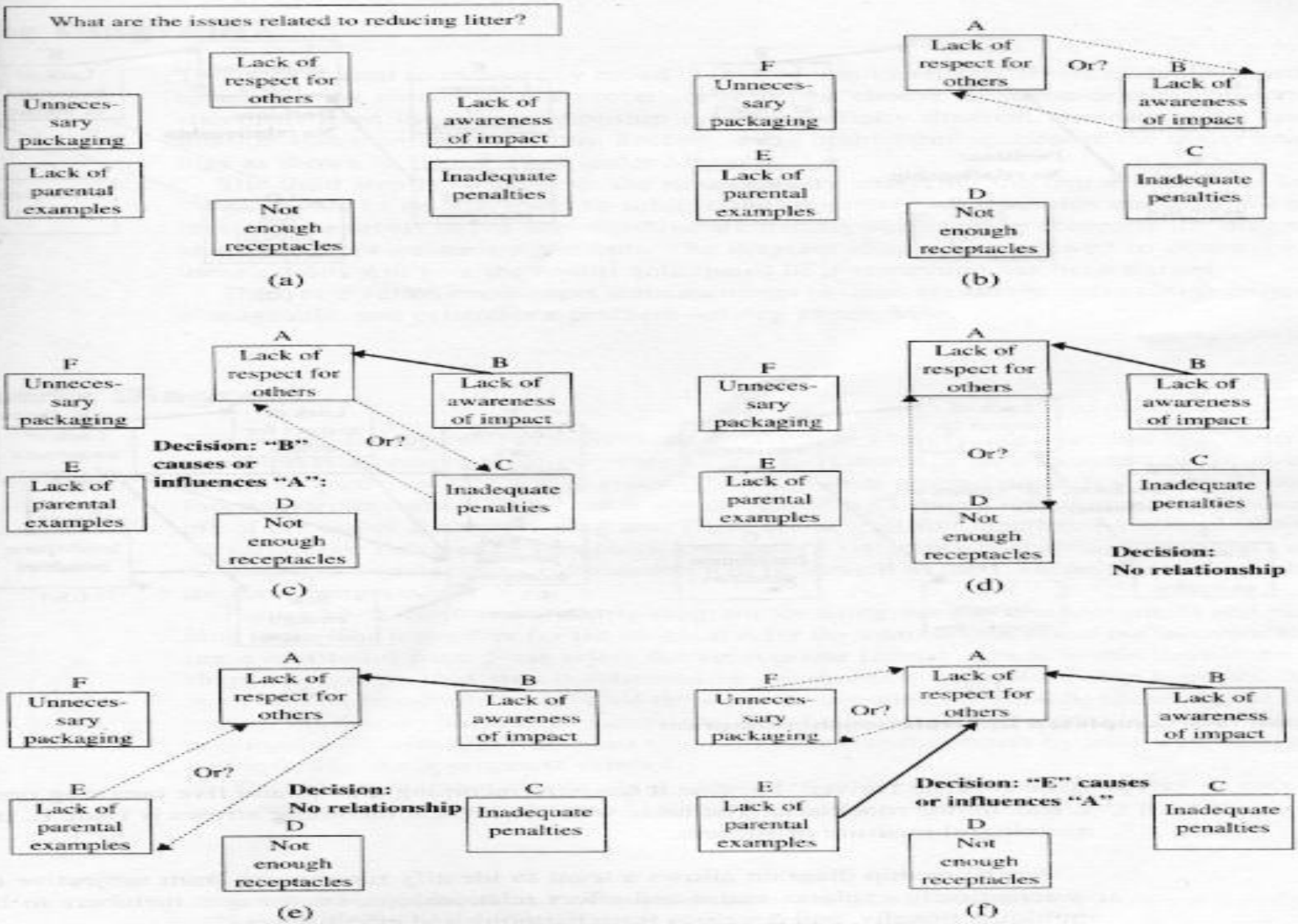


Figure 19-2 Interrelationship Diagram for First Iteration

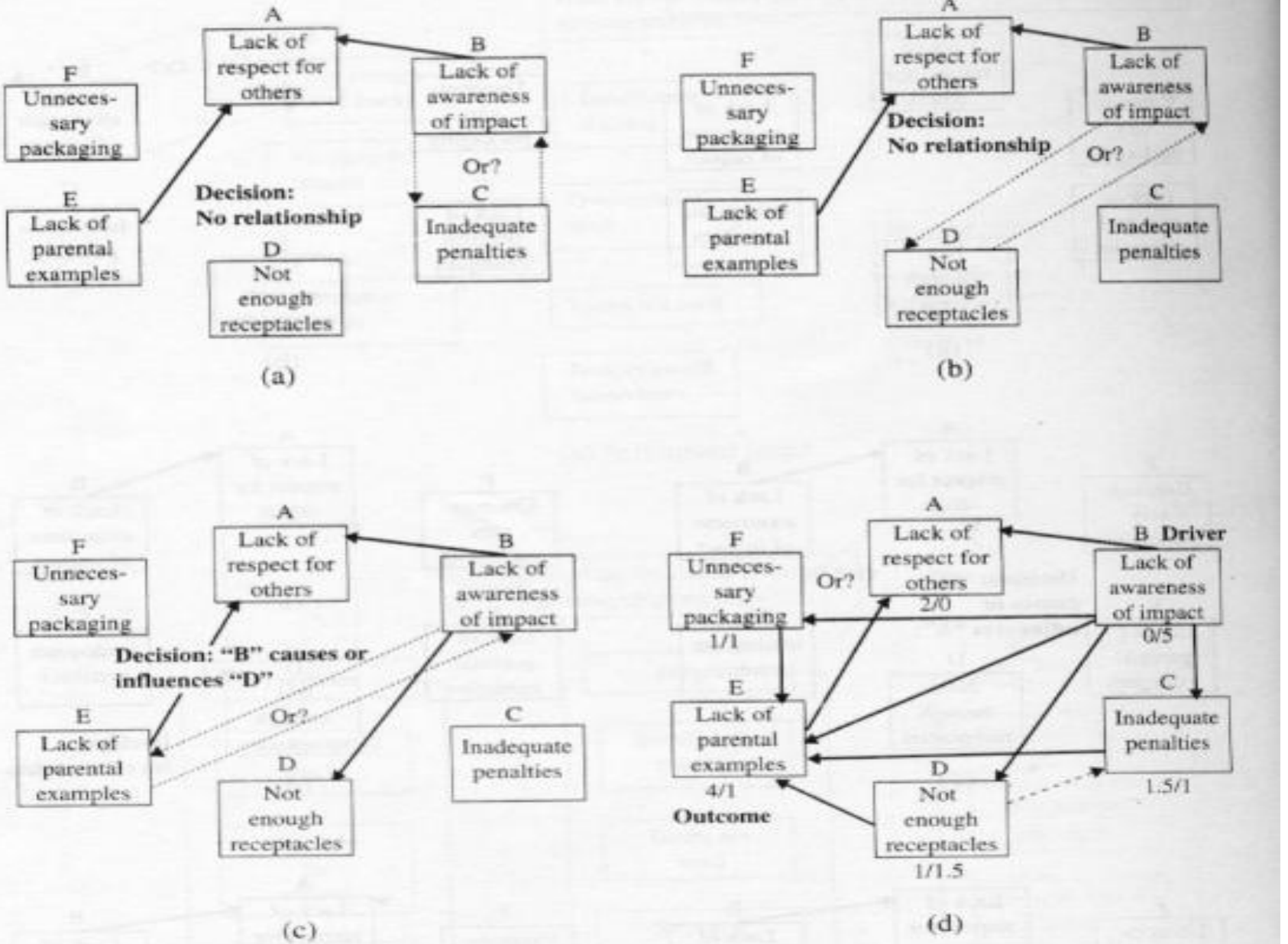


Figure 19-3 Completed Interrelationship Diagram

PRIORITIZATION MATRICES

These tools prioritize issues tasks, characteristics and so forth, based on weighted criteria using a combination of tree and matrix diagram techniques. Once prioritized, effective decisions can be made.

Procedure:

a) Construct an L-shaped matrix combining the options, which are the lowest level of detail of the tree diagram with the criteria.

b) Determine the implementation criteria using the nominal grouping technique (NGT) or any other technique that will satisfactorily weight the criteria. In this situation, the team decides to use the four criteria shown at the top of the matrix.

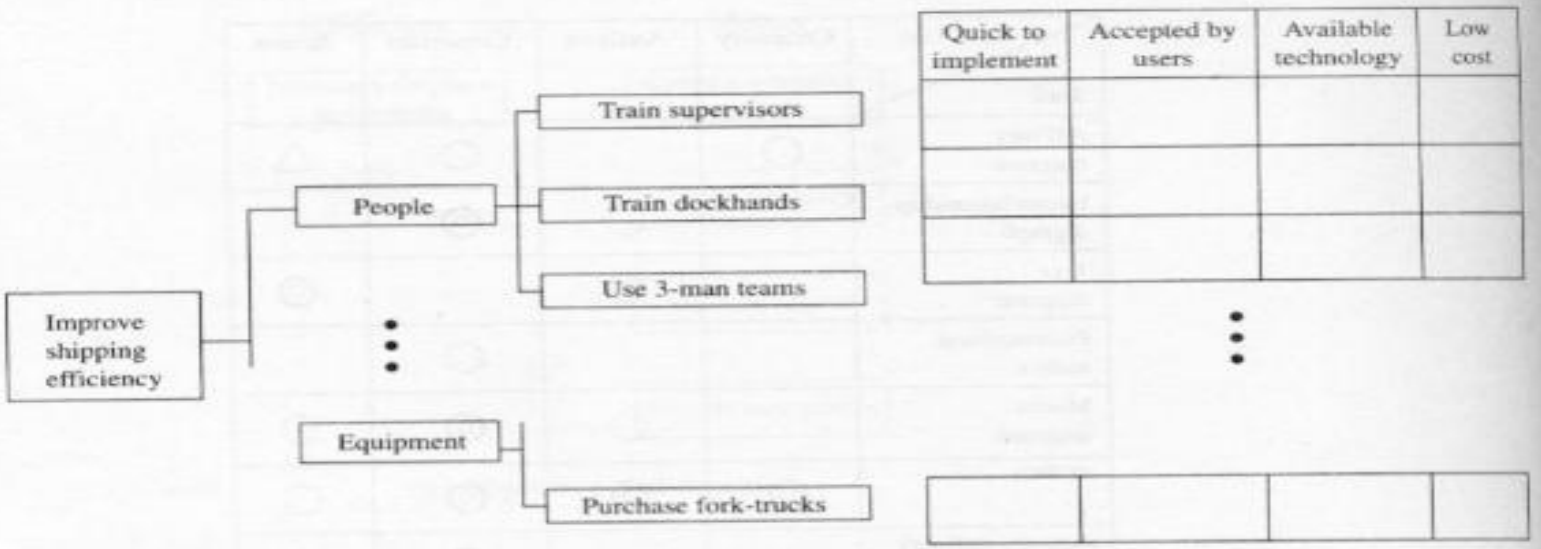


Figure 19-6 Prioritization Matrix for Improving Shipping Efficiency

TABLE 19-1

Improve Shipping Efficiency Using the Consensus Criteria Method

	CRITERIA				
Options	*Quick to Implement*	*Accepted by Users*	*Available Technology*	*Low Cost*	*Total*
Train Operators	13(2.10) = 27.3	15(1.50) = 22.5	11(0.45) = 5.0	13(0.35) = 4.6	59.4
Train Supervisors	12(2.10) = 25.2	11(1.50) = 16.5	12(0.45) = 5.4	8(0.35) = 2.8	49.9
Use 3-person Teams	8(2.10) = 16.8	3(1.50) = 4.5	13(0.45) = 5.9	14(0.35) = 4.9	32.1
			•		
			•		
			•		
Purchase Fork-trucks	6(2.10) = 12.6	12(1.50) = 18	10(0.45) = 4.5	1(0.35) = 0.4	35.5

c) Prioritize the criteria using the NGT. Each team member weights the criteria so the total weight equals 1.00 and the results are totaled for the entire team as shown below.

d) Using NGT, rank order the options in terms of importance by each criterion, average the results, and round to the nearest whole number. Thus, this ranking should be from 1 to the number of options.

e) Compute the option importance score under each criterion by multiplying the rank by the criteria weight as shown in the Table . The options with the highest total are those that should be implemented first.

Criteria	Member #T	Member #2	Total
Accepted by users	.30	.25	1.50
Low cost	.15	.20	0.35
Quick to implement	.40	.30	2.10
Available technology	I5	-25	0.45
	1.00	1.00	

5S

5 S: A technique used to establish and maintain quality environment; Propounded by Takashi Osada.

What is 5s?

5S, abbreviated from the Japanese words **Seiri, Seiton, Seison, Seiketsu, and Shitsuke**, are simple but effective methods to organize the workplace.

1.) Seiri (Sort): Put things in order; (remove what is not needed and keep what is needed)

2.) Seiton (Straighten; Simplify): Proper Arrangement; (Place things in such a way that they can be easily reached whenever they are needed)

3.) Seiso (Shine): Clean; (Keep things clean and polished; no trash or dirt in the workplace)

4.) (Seiketsu) Standardize: Purity; (Maintain cleanliness after cleaning - perpetual cleaning)

5.) Sustain (Shitsuke): Commitment (A typical teaching and attitude towards any undertaking to inspire pride and adherence to standards established for the four components)

The 5S, translated into English are: **housekeeping, workplace organization, cleanup, keep cleanliness, and discipline**. They can be defined as follows:

- Housekeeping. Separate needed items from unneeded items. Keep only what is immediately necessary item on the shop floor.
- Workplace Organization. Organize the workplace so that needed items can be easily and quickly accessed. A place for everything and everything in its place.
- Cleanup. Sweeping, washing, and cleaning everything around working area immediately.
- Cleanliness. Keep everything clean for a constant state of readiness.
- Discipline. Everyone understands, obeys, and practices the rules when in the plant.

Aims of 5S:

•To remove waste from the workplace

•To provide an environment where continuous improvement activities are embraced

•To provide a reduction in non-value added activities and increase productivity.

•To increase safety and morale and also quality

How to get started:

1. Do only one 5S activity at a time and do it thoroughly
2. Set a timetable which can be broken down into manageable chunks
3. Review progress and plan for the next session.
4. Encourage everyone to do their own 5S audits and be empowered.
5. Keep records – especially how things looked before, problems encountered and results of action taken.
6. Aim for workplace evaluations to keep everyone abreast of what is happening and to sot problems before they develop into major complications. The aim is to devise ways that will get everybody competing, in a friendly, but no less intense way.
7. If the 5S progress is recorded on noticeboards, make sure it's kept up to date and changed from time to time.

What benefit we get by practising Five 'S'?

a) A clear work place is high in Productivity

b) A clear work place is high Quality

c) A clear work place helps in Cost Reduction

d) A clear workplace ensures Delivery on Time

e) A clear workplace is Safe for people to work

f) A clear workplace will bring high Morale.

Potential Benefits of 5S:

Implementing 5S methods in the plant would help the company to reduce **waste** hidden in the plant, improve the levels of **quality** and safety, reduce the **lead time** and **cost**, and thus, increase company's **profit**.

The potential benefits of 5S can be summarized by five English **S** or **PQCDS**:

a) Five English S:

Sales - Increase sales (market share).
Savings - Save costs.
Safety - Provide a safety working environment.
Standardization - Standardize the operating procedure.
Satisfaction - Employees and customers satisfaction.

b) PQCDS:

P - Increase productivity.
Q - Improve product quality.
C - Reduce manufacturing costs.
D - Ensure on-time delivery.

S - Provide a safety working environment.