ORGANIZATIONAL LEARNING

George E. Apostolakis
Massachusetts Institute of Technology
apostola@mit.edu

NRC

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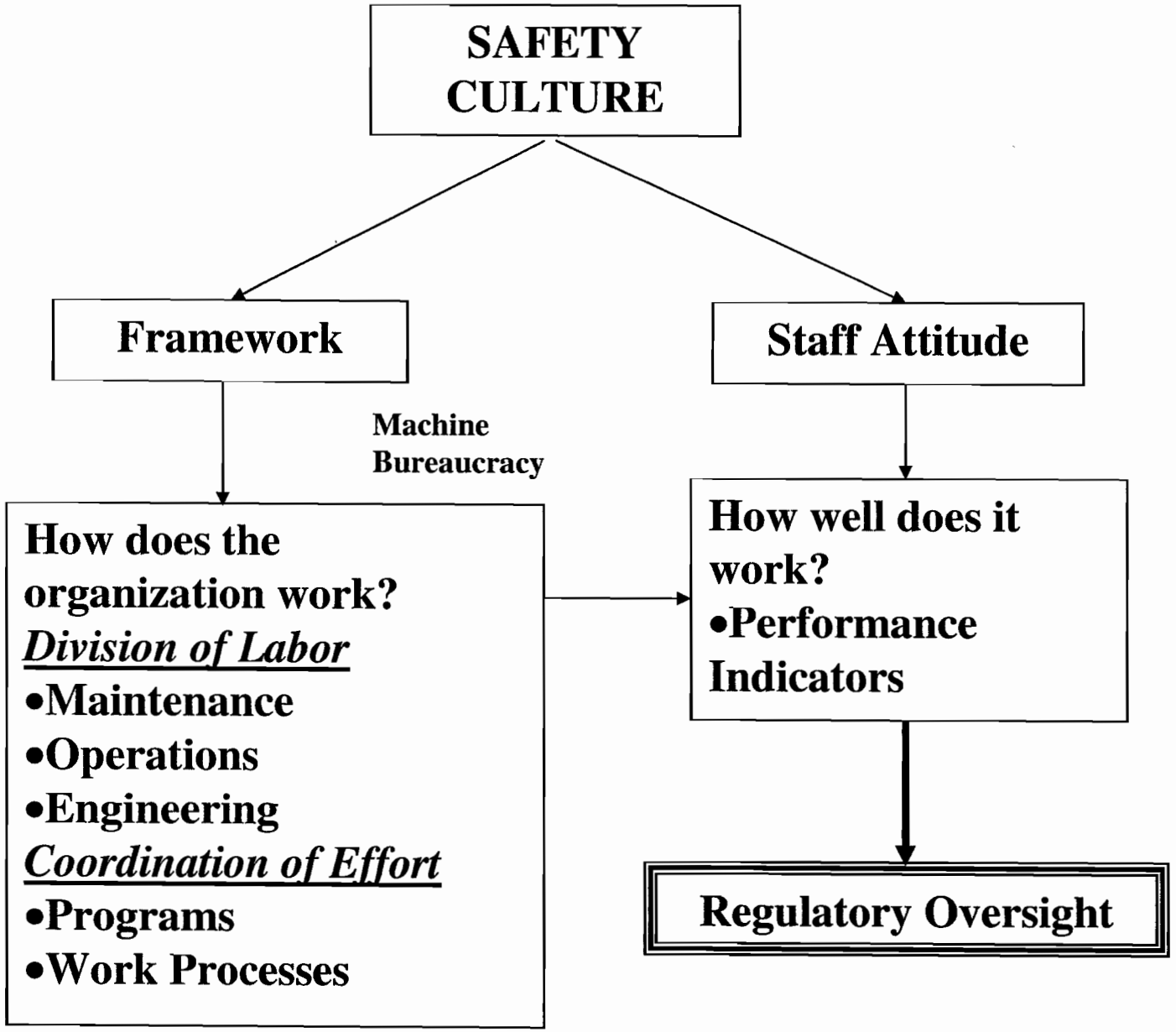
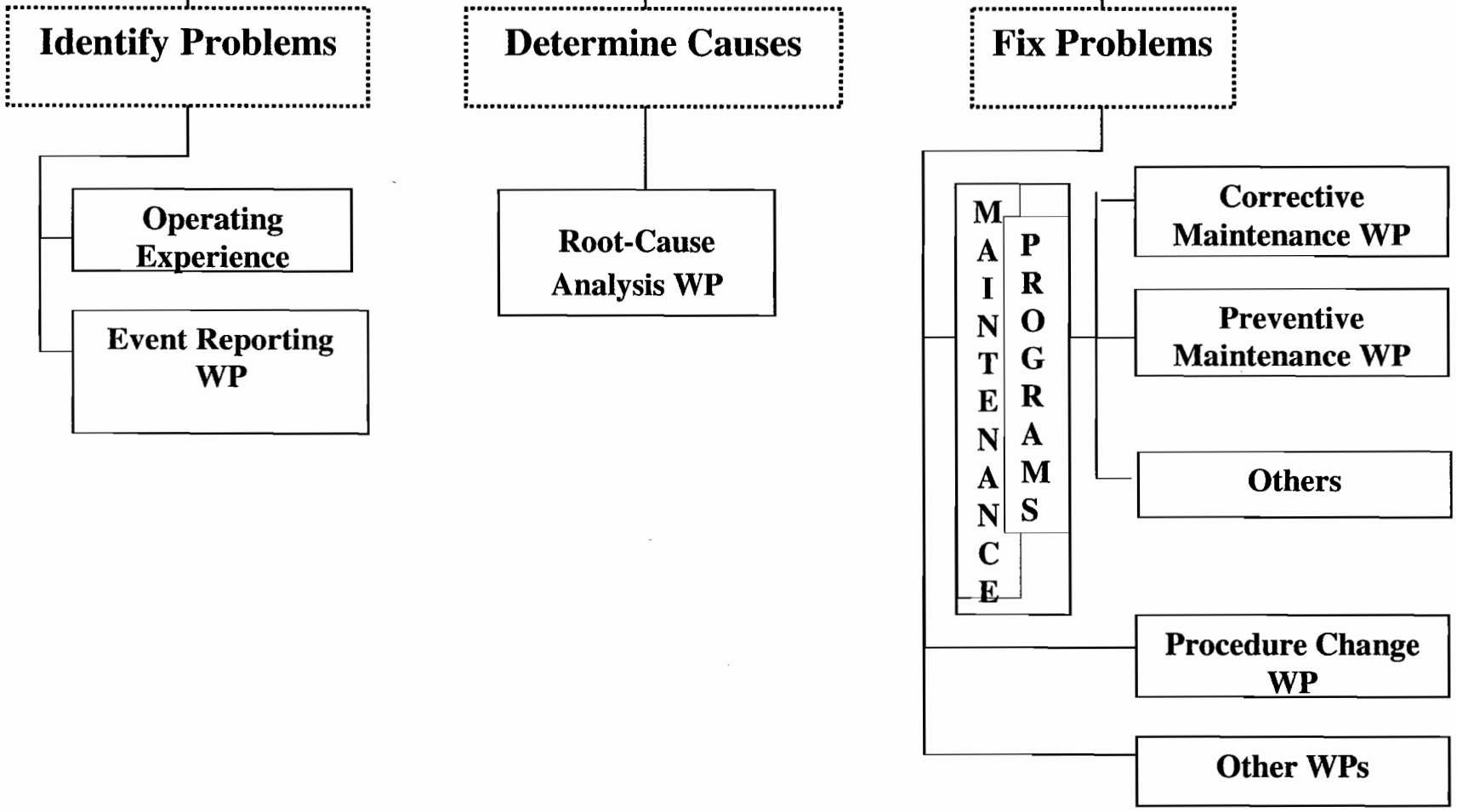
NPPs as Machine Bureaucracies

- Highly specialized
- Routine operating tasks
- Very formalized procedures in the operating core
- Large-scale units at the operating level
- Reliance on the functional basis for grouping tasks
- Relatively centralized power for decision making
- Elaborate administrative structure with a sharp distinction between line and staff

Mintzberg, 1994

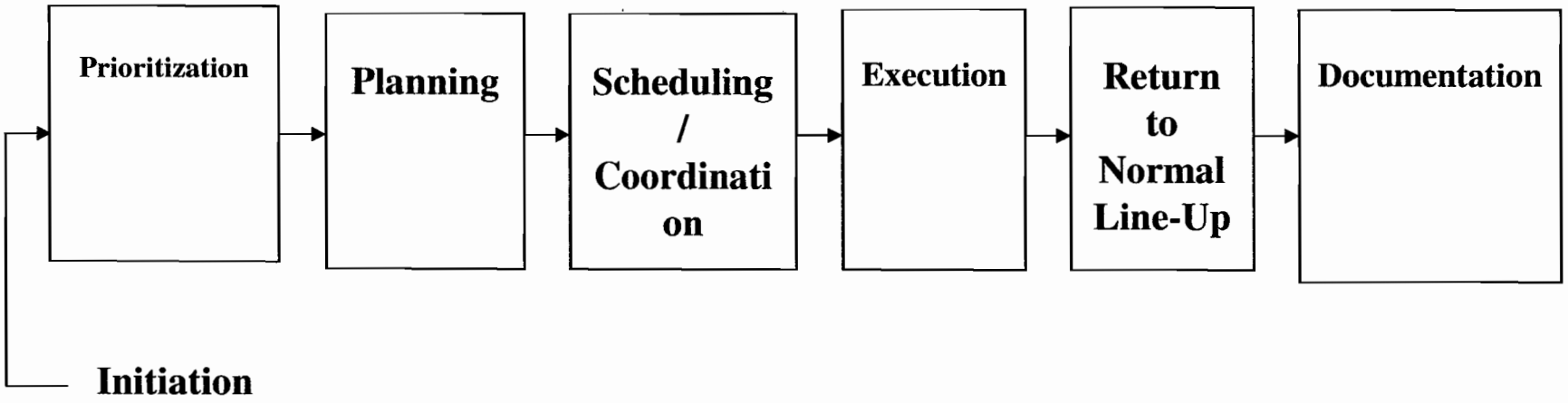

SAFETY CULTURE
Framework
Staff Attitude
Machine Bureaucracy
How does the organization work?
Division of Labor
•Maintenance
•Operations
•Engineering
Coordination of Effort
•Programs
•Work Processes
How well does it work?
•Performance Indicators
Regulatory Oversight

Corrective Action Program



Work Processes

Work Process: **A standardized sequence of tasks that coordinates activities of an organization to achieve a specific goal.**



Definitions of Organizational Learning

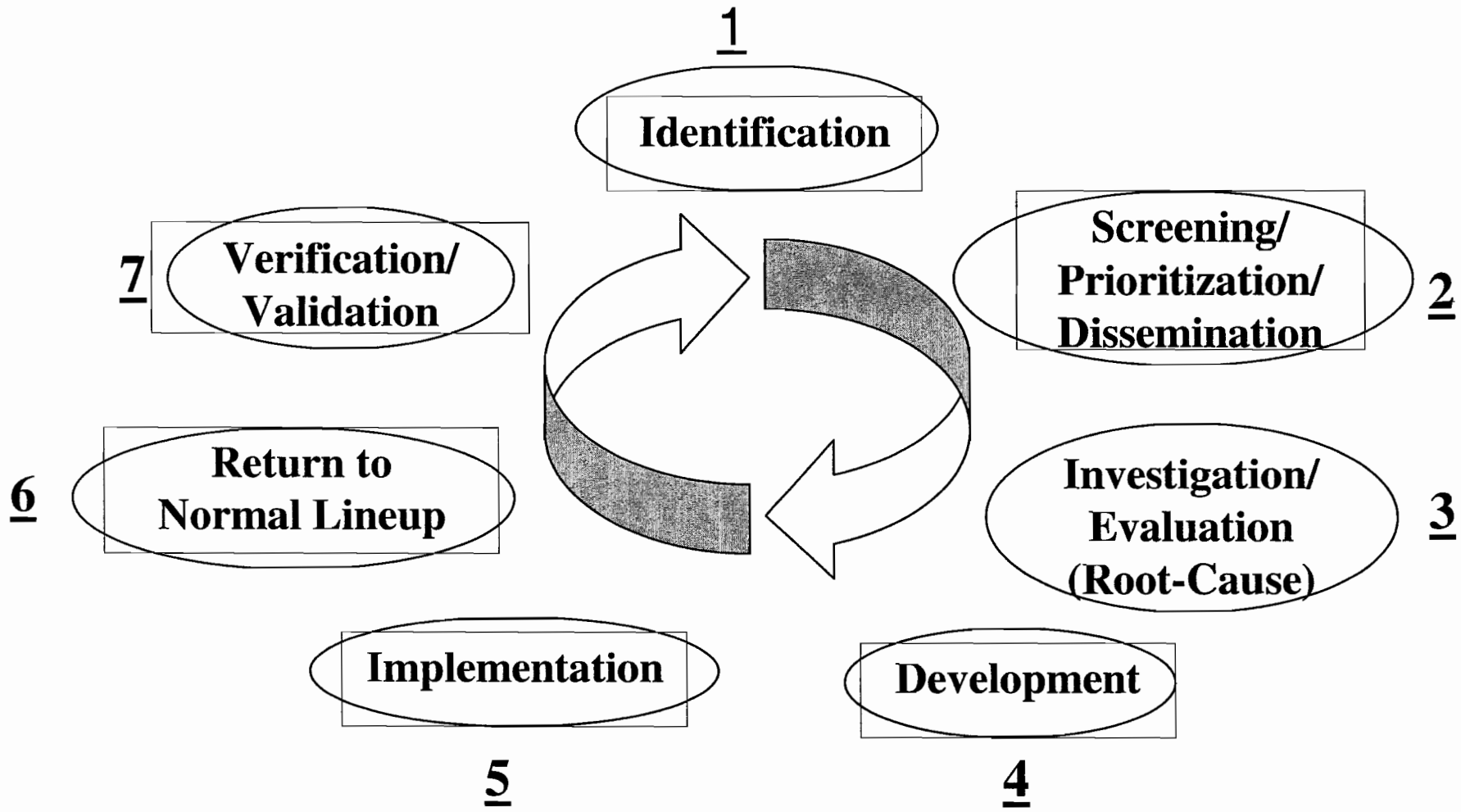
- **Front-End Process: Gathering of information including event evaluations and root-cause analyses.**
- **Back-End Process: Implementation of actions and assessment of effectiveness.**

Carroll, Journal of Management Studies, 35, 699-717, 1998.

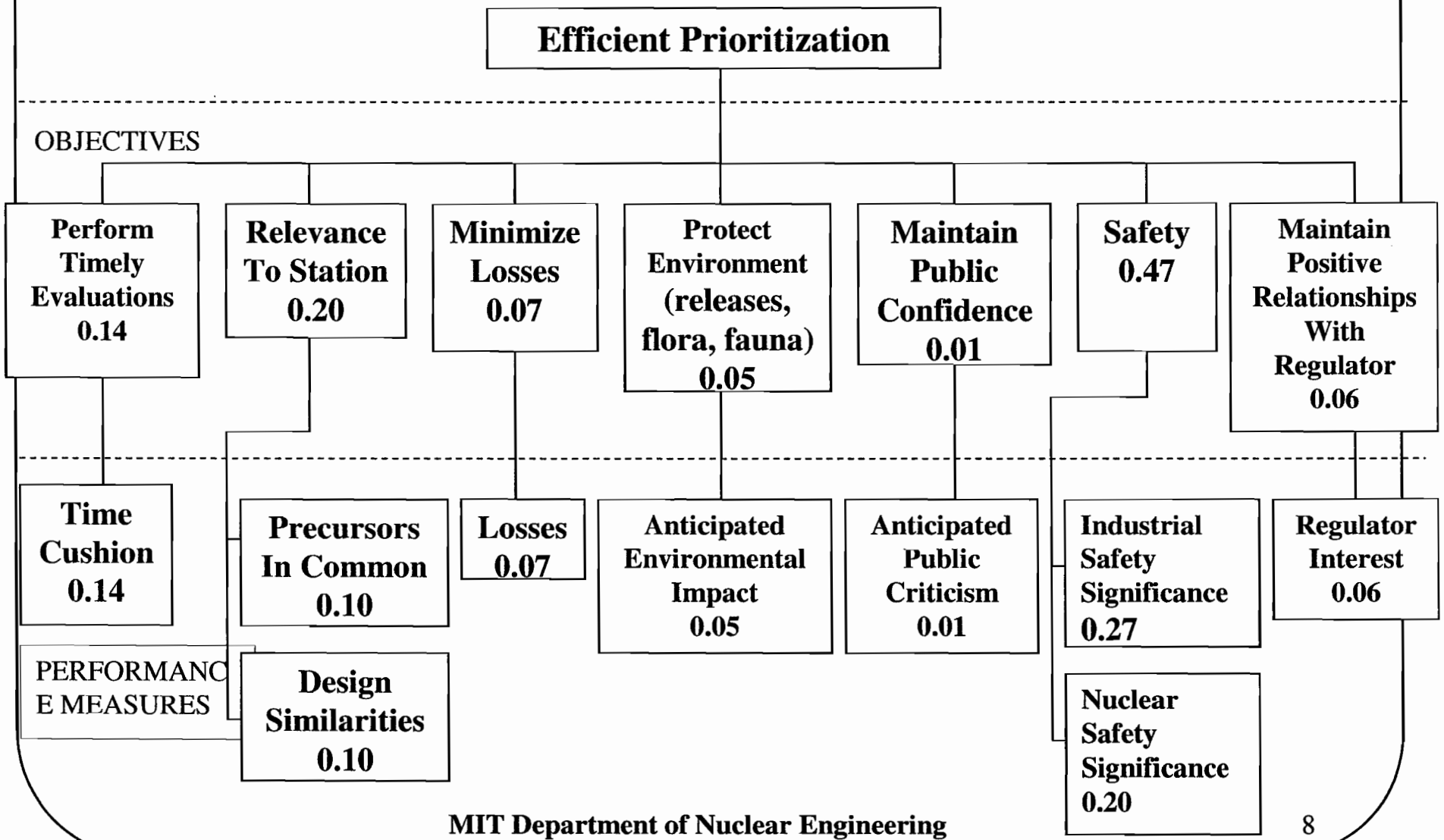
- **Organizational learning refers to collective learning, not just encouraging individuals to exchange information**
- **The organizational learning cycle has four steps:**
  - **generation of information**
  - **integration of information into the organization,**
  - **interpretation of the information**
  - **acting on the information to implement change.**

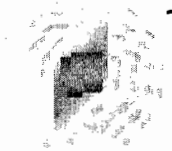
Dixon, The Organizational Learning Cycle: How We can Learn Collectively. McGraw-Hill. New York, 1994.

Organizational Learning



Step 2: Value Tree





Design Similarities

Level	Description
3	Event involved equipment that the plant has
2	Event occurred on a 4-loop Westinghouse PWR
1	Event occurred on a Westinghouse PWR
0	Event occurred on a non-Westinghouse PWR or BWR

Prioritization Results

$$\overline{PI}_j = \sum_{i=1}^{N_{PM}} w_i \bar{u}_{ij}$$

Event or Report Date	Performance Index	Title
2/15/2000	0.52	Steam Generator Tube Failure
8/30/1999	0.44	Core recriticality during Hot-Leg switchover
4/6/2000	0.1	Reduced Pump Seal Life because of Improper Venting

Step 3: Root-Cause Analysis

- To provide a systematic way to conduct root-cause analysis to:
  - Relate failures to latent conditions
  - Relate latent conditions to organizational factors
  - Potentially connect oversight lapses to latent conditions within regulatory agency
  - Create easily searchable summary database
  - Prevent future incidents through effective organizational learning

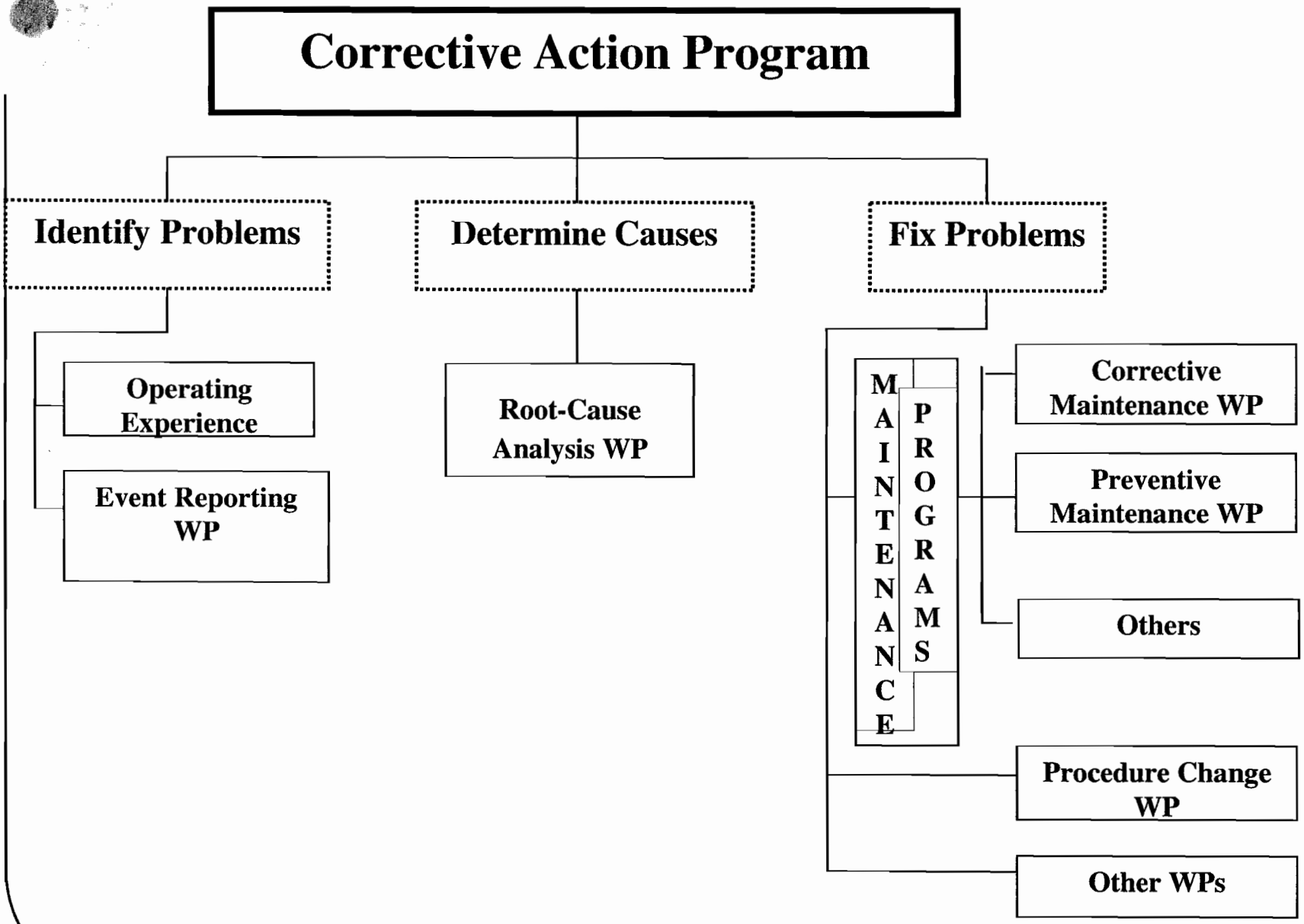
Latent Conditions

- **Weaknesses that exist within a system creating contexts for human error "beyond the scope of individual psychology" (Reason, 1990)**

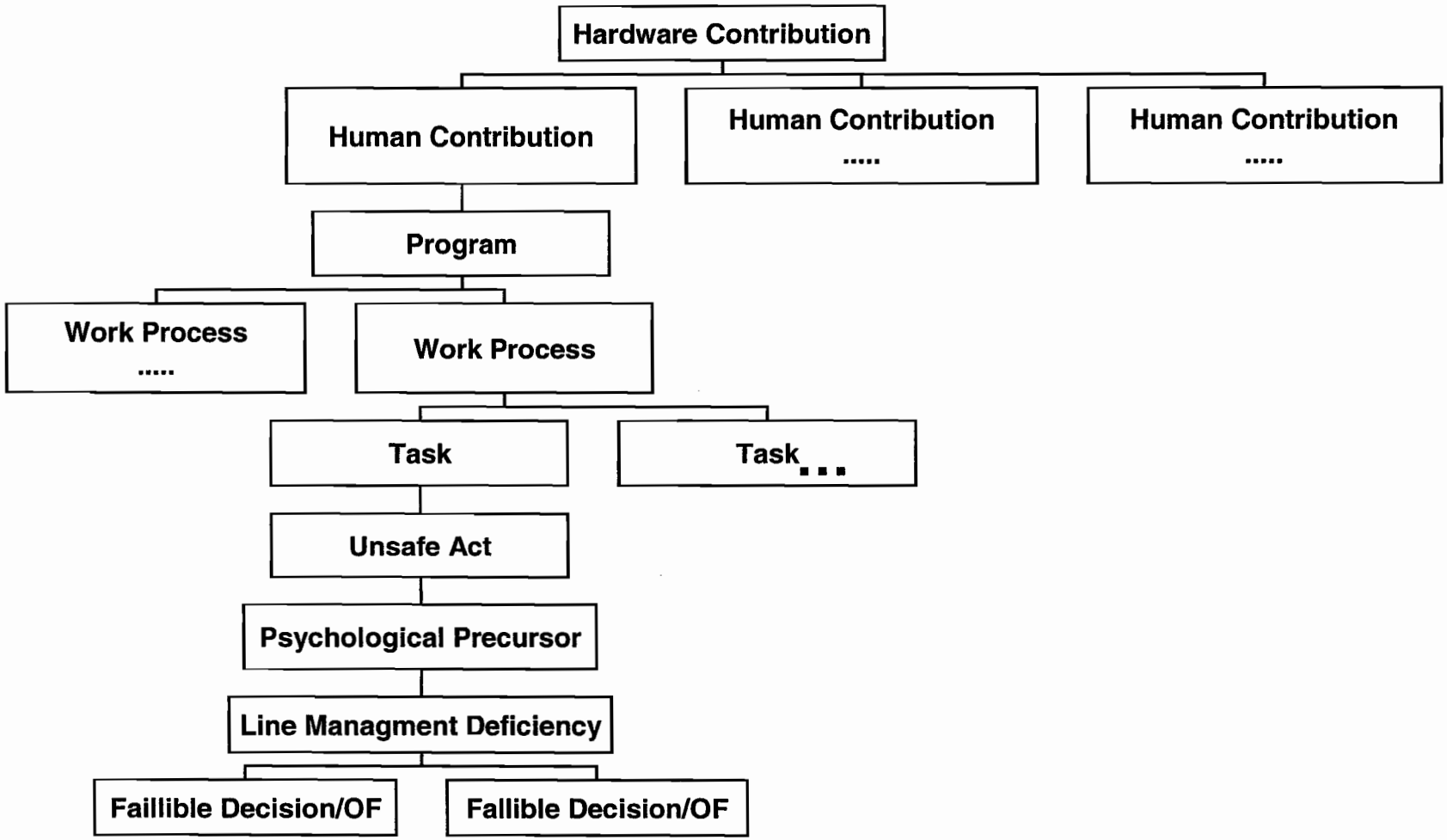
- **<u>Examples:</u> poor procedures, inadequate training, bad management policies, poor organizational learning**

Objectives

- **Uniform basis for analysis**
- **Easy access to past analysis summaries to help track/prevent repeat problems**
- **Performance based**
- **Explicit focus on decision-making perspective of *individuals* (within the organization)**
- **Based on how work is actually done**


Corrective Action Program
Identify Problems
Determine Causes
Fix Problems
Operating Experience
Event Reporting WP
Root-Cause Analysis WP
MAINTENANCE PROGRAMS
Corrective Maintenance WP
Preventive Maintenance WP
Others
Procedure Change WP
Other WPs

Extended Root Cause Analysis



Weil and Apostolakis, 1999

Computer-Aided Technique for Identifying Latent Conditions (CATILaC)

- Work Process Database
- List of Common Human Contributions
- List of Organizational Factors
- Ability to Search for Events by Specific Organizational Factor

Marcinkowski, Weil, and Apostolakis, 2001

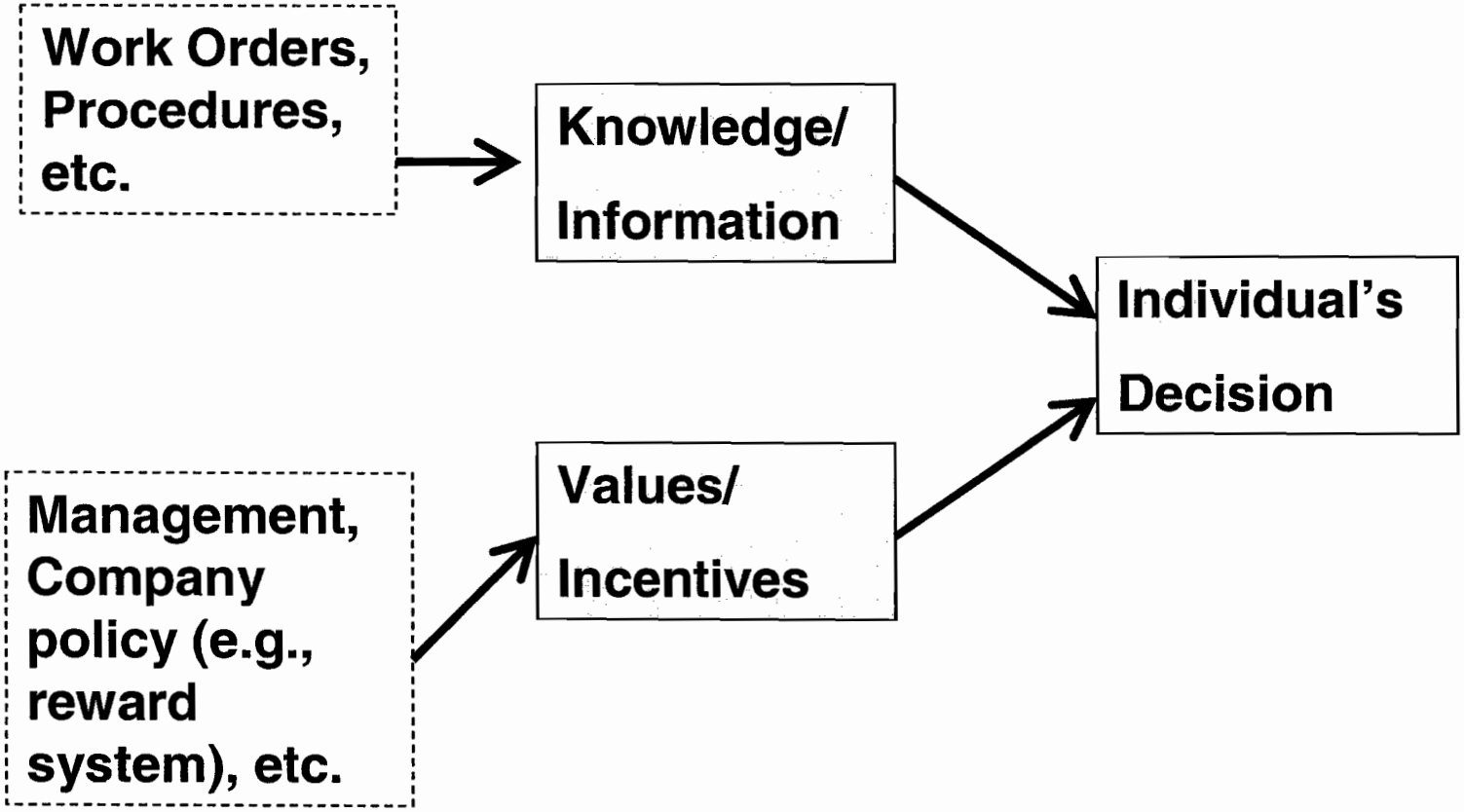
Conclusions from the Examination of Operating Experience

- Significant incidents are the result of combinations of hardware and human failures to which organizational factors are major contributors
- Organizational factors influence the successful outcome of particular tasks within the work process
- Many work processes have tasks in common
- Shared tasks, e.g., prioritization, create the potential for common-cause failures between dissimilar components

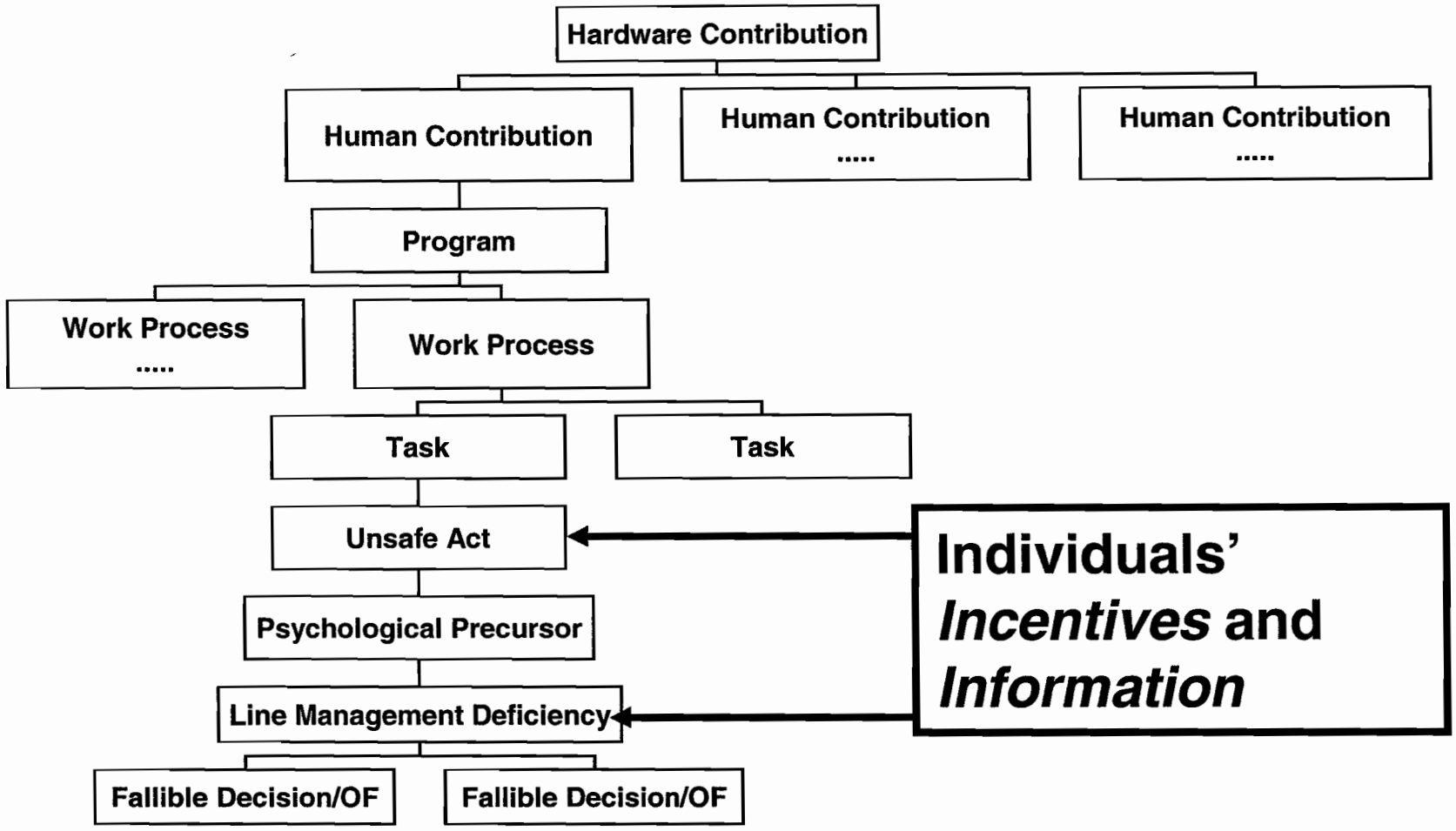
Important Organizational Factors

Organizational Factor	Definition	Tasks Influenced
Communication	Refers to the exchange of information, both formal and informal.	Pervasive – Most important between different units and departments
Formalization	Refers to the extent to which there are well-identified rules, procedures and/or standardized methods for routine activities and unusual occurrences.	Execution
Goal Prioritization	Refers to the extent to which plant personnel acknowledge and follow the stated goals of the organization and the appropriateness of those goals.	Prioritization
Problem Identification	Refers to the extent to which plant personnel use their knowledge to identify potential problems.	Planning, scheduling, and return to normal line-up
Roles and Responsibilities	Refers to the degree to which work activities are clearly defined and the degree to which plant personnel carry out those work activities.	Execution
Technical Knowledge	Refers to the depth and breadth of requisite understanding that plant personnel have regarding plant design and systems, and the phenomena and events that bear on their safe and reliable operation.	•Job specific knowledge – execution •Broad based knowledge – prioritization, planning, scheduling, and other tasks

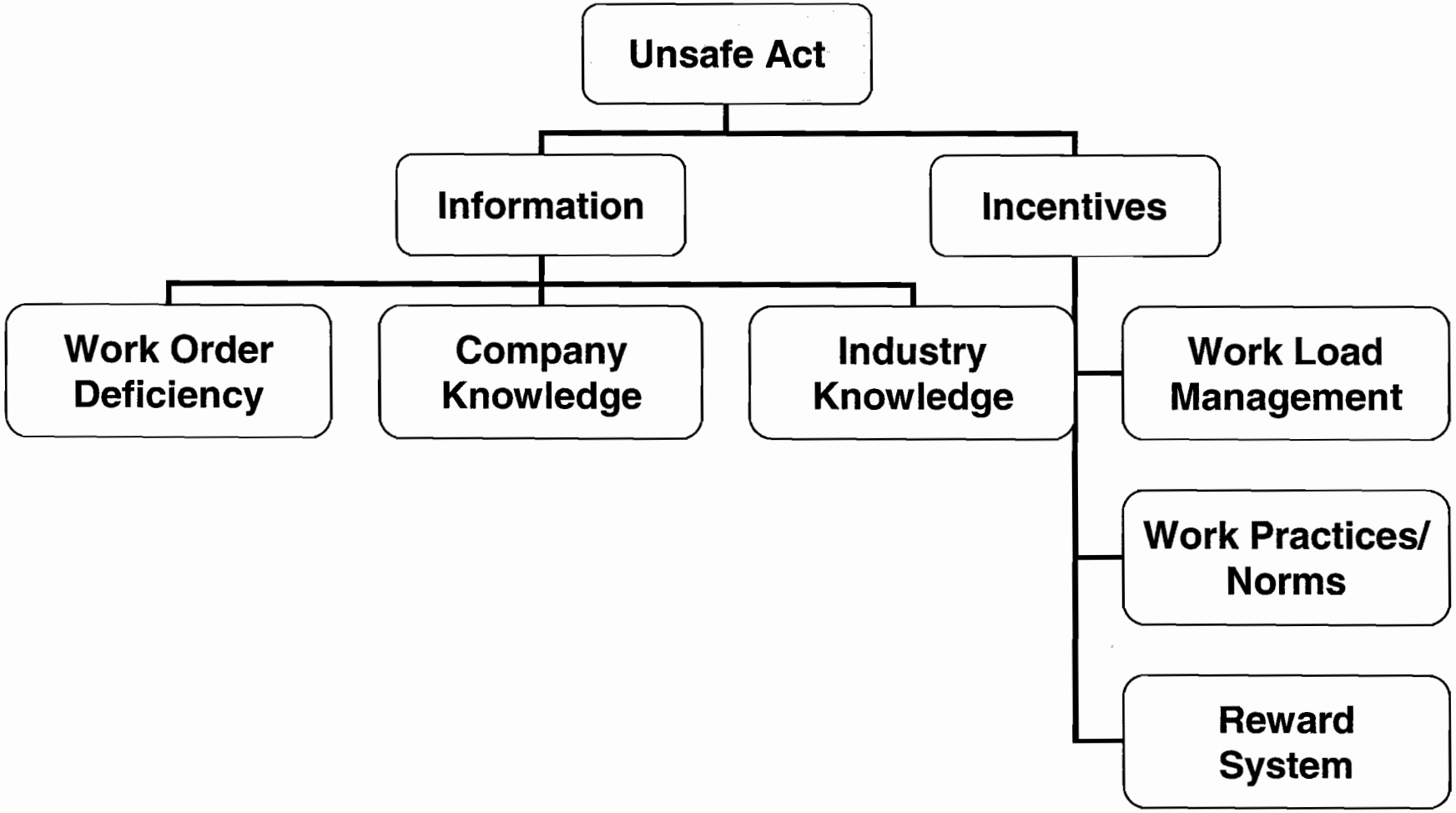
Individual's Decision-Making Perspective



Augmented CATILaC



Details


Unsafe Act
Information
Incentives
Work Order Deficiency
Company Knowledge
Industry Knowledge
Work Load Management
Work Practices/ Norms
Reward System

Example - Calvert Cliffs, May 2001

- AFW pump turbine bearing failure, due to temperature excursion
- Caused by sealant intrusion into oil because sealant was over-applied
- NRC deemed this a risk-significant finding ("Yellow" based on Significance Determination Process) because AFW pump was rendered unavailable

US Nuclear Regulatory Commission, Inspection Report 50-317/01-009

NRC and Licensee Findings

- **Causes:**
  - **Inadequate training, ambiguous vendor manual instructions**
  - **Personnel *and* supervisors unaware of related risk significance**
  - **Maintenance personnel thought they were being conservative**

Licensee's Corrective Actions

- **Reinforce standards and expectations to follow instructions**
  - **Special training sessions for maintenance personnel involved**
- **Increased supervision, awareness of risk significance**
- **Ambiguous promise to address weakness in corrective action process**

Comments

- **Both maintenance personnel *and* line manager had the same information problem – "increased supervision" would not have prevented the problem**
- **"Be more aware" is not useful guidance**
- **Doubtful that probability of similar incident is reduced outside the narrow focus on sealant intrusion into bearing oil**

Augmented CATILaC Results

Hardware Contribution: Over-application of sealant

Human Contributions:

1. **Problem repaired incorrectly/incompletely**
2. **Inadequate procedures provided (information deficiency)**
3. **Procedure not followed**

Individual Information: Work Order Deficiency

Insights from Other Case Studies

- **Deficient work orders and procedures and "Procedure not followed" found multiple times; understanding *why* could improve recommended corrective actions**
- **Deficiencies in condition reporting, corrective action programs found often**
- **Information requirement has potential to mitigate deficiencies in other cross-cutting issues**

How Can these Results Help?

- Not intended to be rigid recommendations.
- Management must evaluate the results before action is taken.
- Identify specific areas at which corrective actions should be directed.
- Organizational factors are linked to a program, work process, and task in which deficiencies in the area of that factor contributed to the event.
- It's a pragmatic approach that is performance-based.

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