ICH Q 10 AND BEYOND

THE PHARMACEUTICAL QUALITY SYSTEM (PQS)

PRESENTED BY

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LEARNING IS UNCOMFORTABLE

TRAINING IS ABOUT CHANGE

OUTLINE

Part 1. ICH Q10:

- **System**
- **Process**
- **Senior management responsibilities**
- **Knowledge management**
- **“Deficiencies” in ICH Q 10**
- **Human error**
- **Waste**

Part 2. Operational Excellence:

- **Definitions**
- **Various models**
- **Maturity scales**
- **Implementation/planning/change**
- **Conclusions**
- **Appendices - tools**

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PHARMACEUTICAL QUALITY SYSTEM

A model for an effective quality management system for the pharmaceutical industry.

ICH Q10, June 2008

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SYSTEM

A system is
- **a group of parts or components**
- **that work together**
- **to achieve a common goal**

(a system is composed of interrelated processes)

Goal - Products that are safe, effective and available that meet the needs of our customers (patients and the health care professionals that administer them).

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SYSTEM:

- **2 dimensions - integration and maturity**
- **metrics as a measure of system health**

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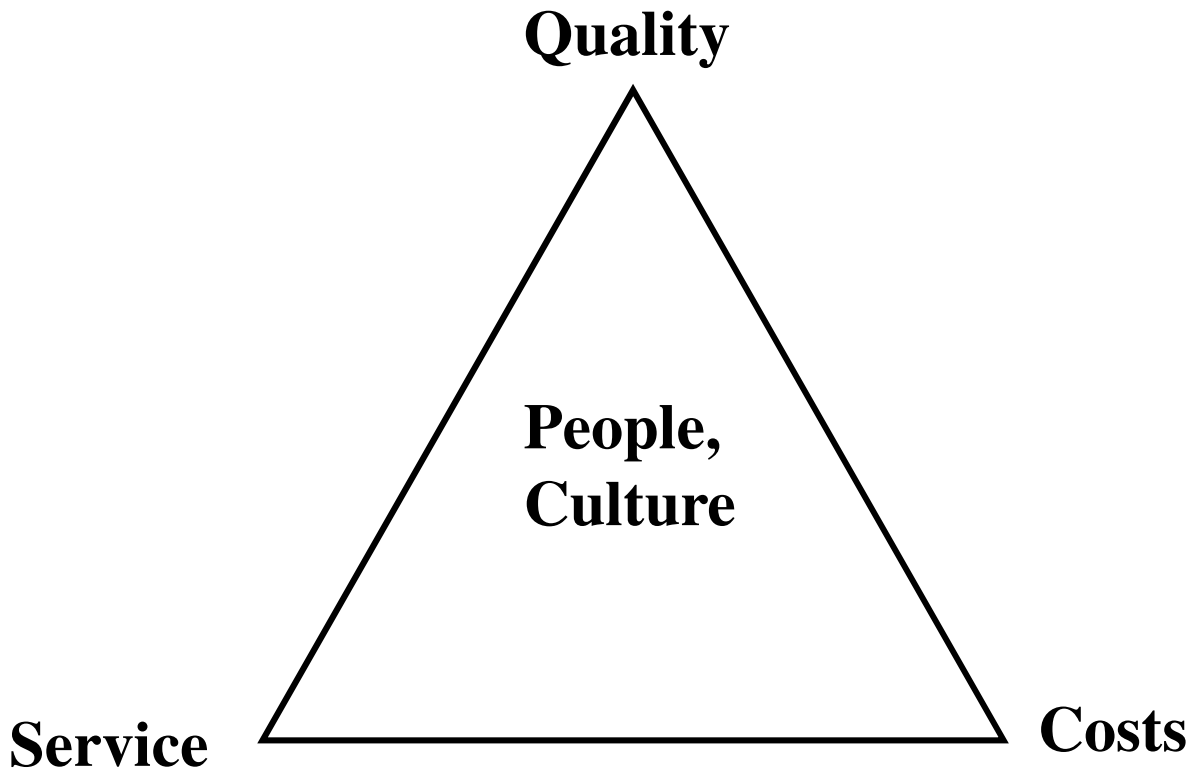
Goals – customer, stakeholder and employee satisfaction



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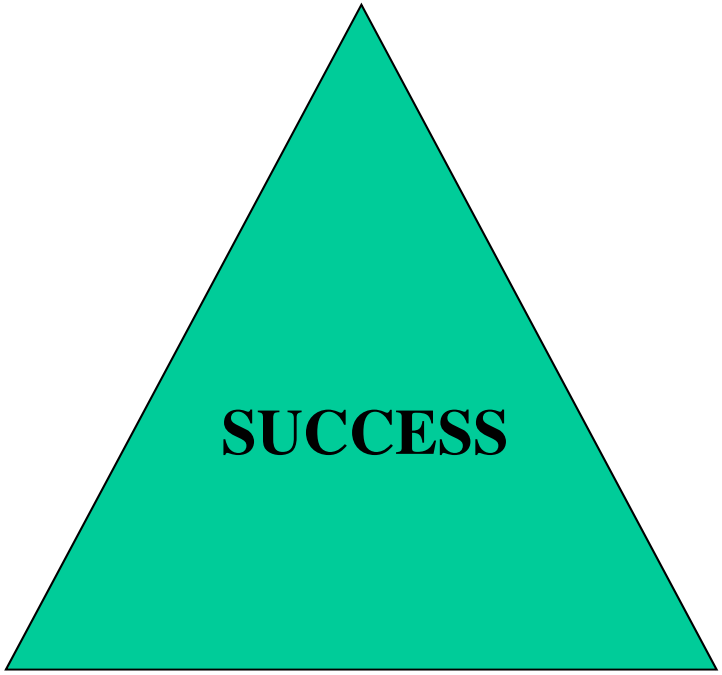
THE QUALITY SYSTEM

QUALIFIED PEOPLE



PROCESSES

- Core (production)
- Supporting
- Supplier
- Management

CULTURE

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QUALIFIED PEOPLE

- **They have the necessary skills to perform their work safely, effectively and efficiently; and are motivated to do so.**
- **They understand what is important and why.**
- **They know the total flow of their processes, their role in them, the performance of their processes and how to control or adjust them when necessary.**
- **They know how to identify and resolve problems and how to improve their processes.**

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CULTURE/VALUES

1. **Customer focused (internal and external), patient first (Quality Policy)**

2. **Quality is responsibility of every employee (Quality Policy)**

3. **Quality not compromised by cost**

4. **Employee empowerment**

5. **Continuous improvement**

6. **Emphasis on prevention**

7. **Balance between short term and long term**

8. **Scientific approach**

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Culture/Values

9. Teamwork

10. Integrity

11. Drive out fear (Deming's 14 points)

12. Mitigate patient, employee and company risk

13. Give priority to learning - individual and organizational

14. Quality by Design, not Quality by Inspection

15. Beyond compliance to excellence

16. Innovation

17. Reduce waste

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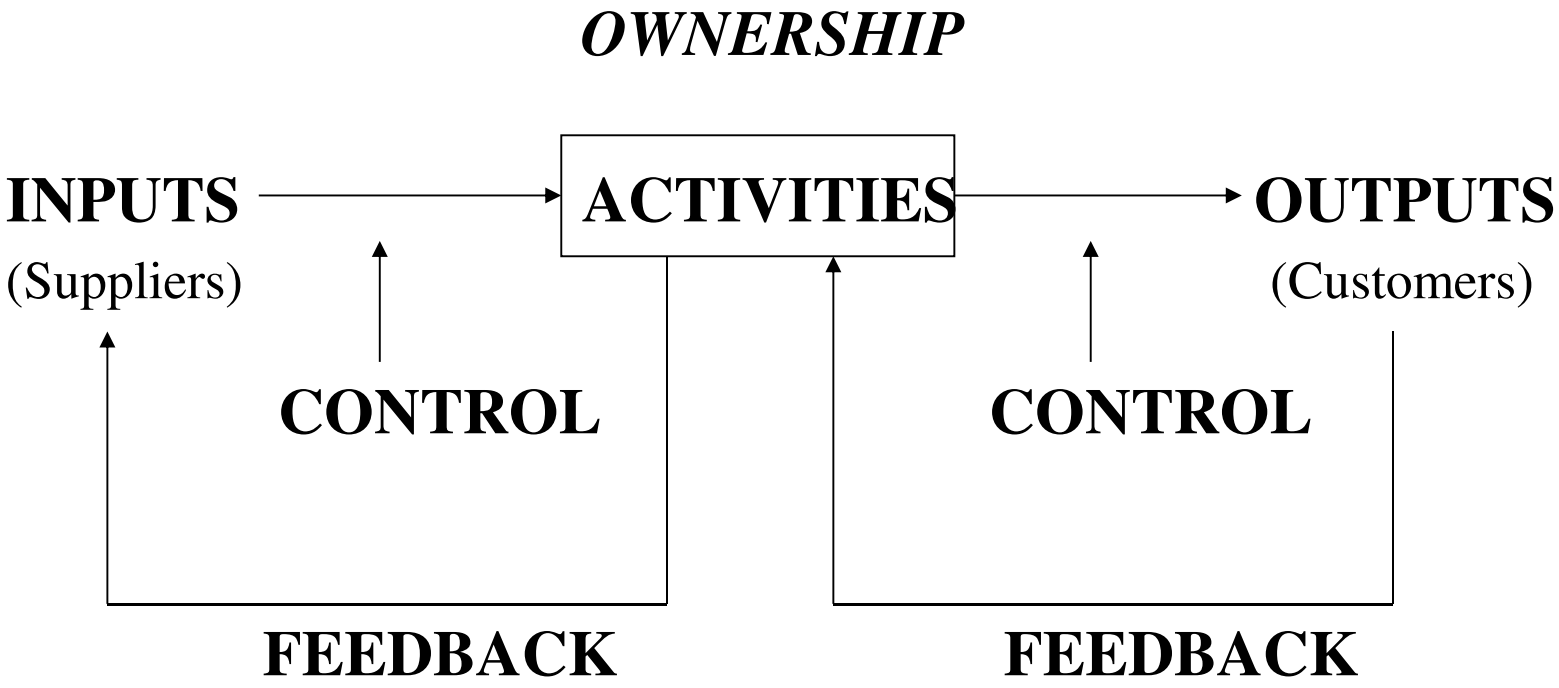
PROCESS



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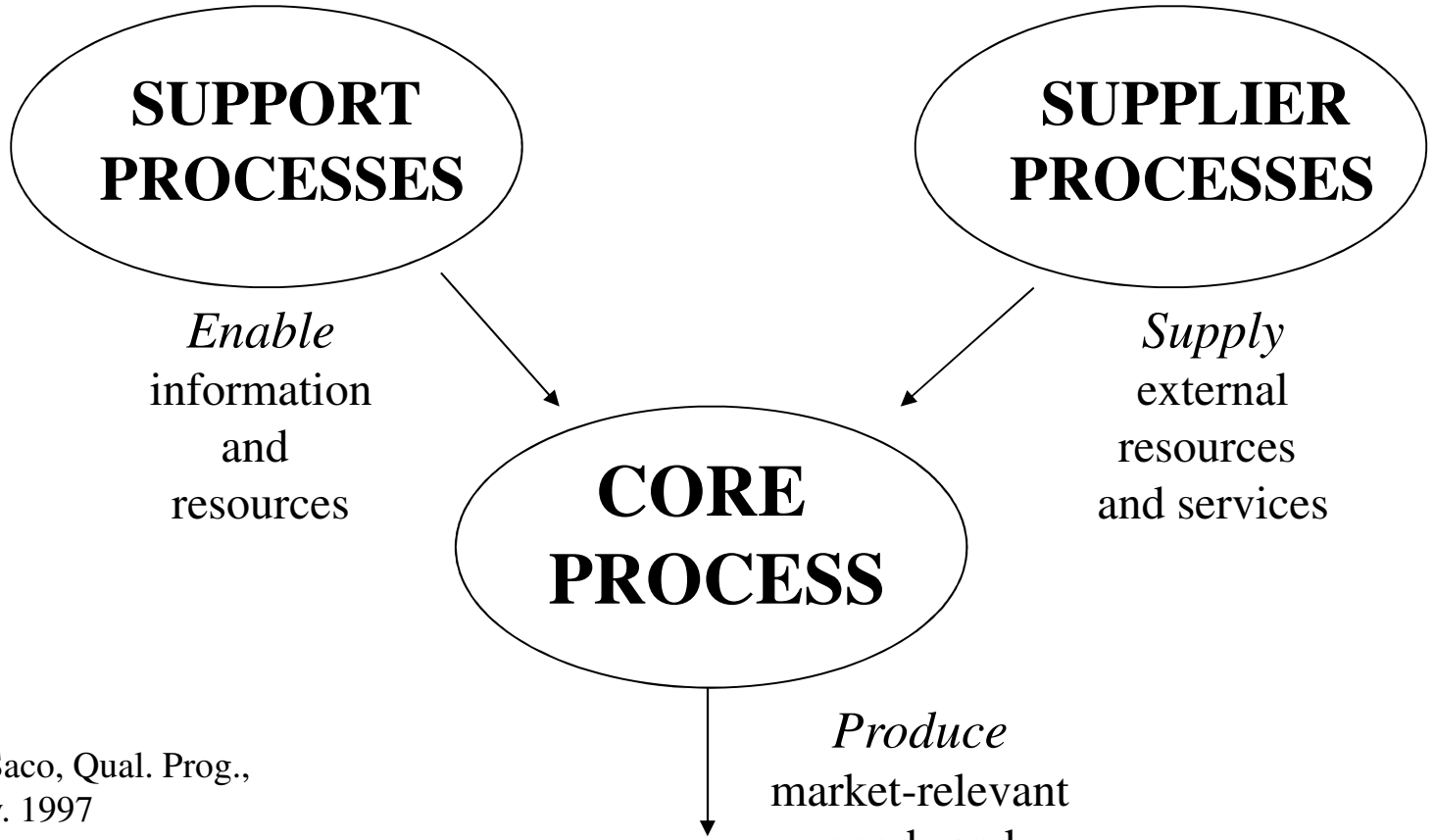
TYPES OF PROCESSES



R. Saco, Qual. Prog., Nov. 1997

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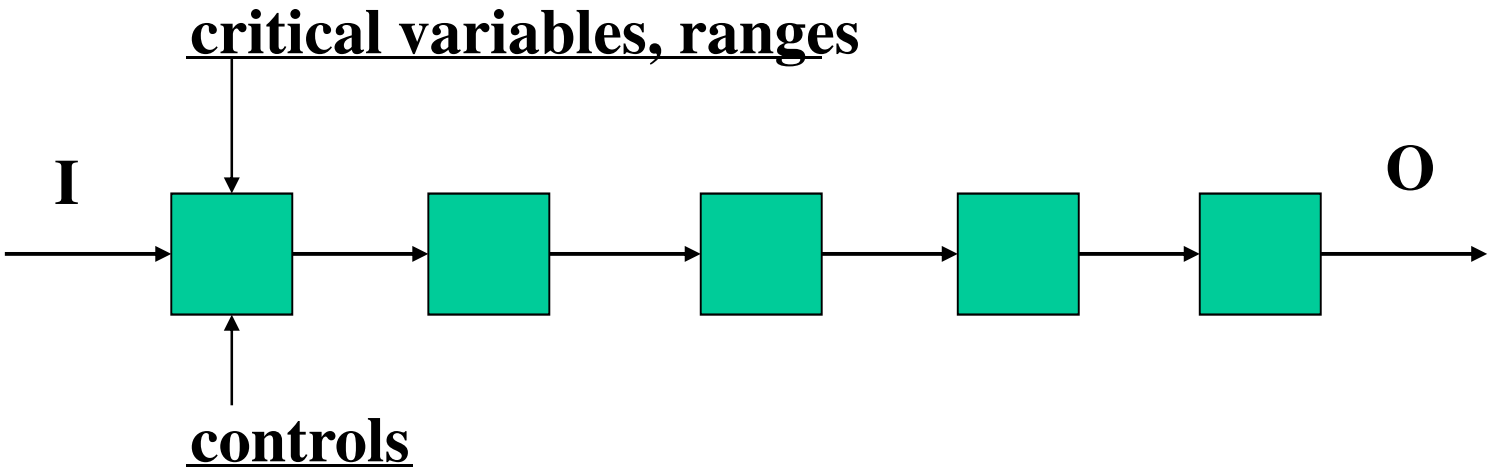
CORE PROCESS



DESIGN – capability, validation, in-control

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SUPPLIERS – THE PROCESS

Selection

Qualification

Contract

Monitoring

On-going Communication

Recognition

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SUPPORTING QUALITY PROCESSES

Audits
Change Control
Documentation*
Facilities, Equipment, Critical Systems (Calibration)
Failures/Deviations
Artwork/Labeling
Maintenance
Materials Management
New Product Introduction
Product Quality Performance (complaints, adverse reactions)
Product Release
Product Transfer
Quality Planning
Recalls
Returned Goods
Stability/Expiration Dating
Testing Methods
Suppliers - Supply Chain Mgn.
Training
Trend Analysis (Annual Review)
Validation

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MANAGEMENT PROCESSES

1. Design of QS, including quality policy, organizational structure, integration and alignment
2. Implementation and communication of QS
3. Setting objectives
4. Monitoring of QS (data, metrics)
5. Maintenance of QS
6. Communication - top-down, bottom-up and crosswise
7. Definition of roles, responsibilities and interrelationships
8. Management review
9. Establish mechanisms for continual improvement, strategic quality plan
10. Provide appropriate rewards and recognition, and consequences as needed
11. Provide resources - tools, time, money, training

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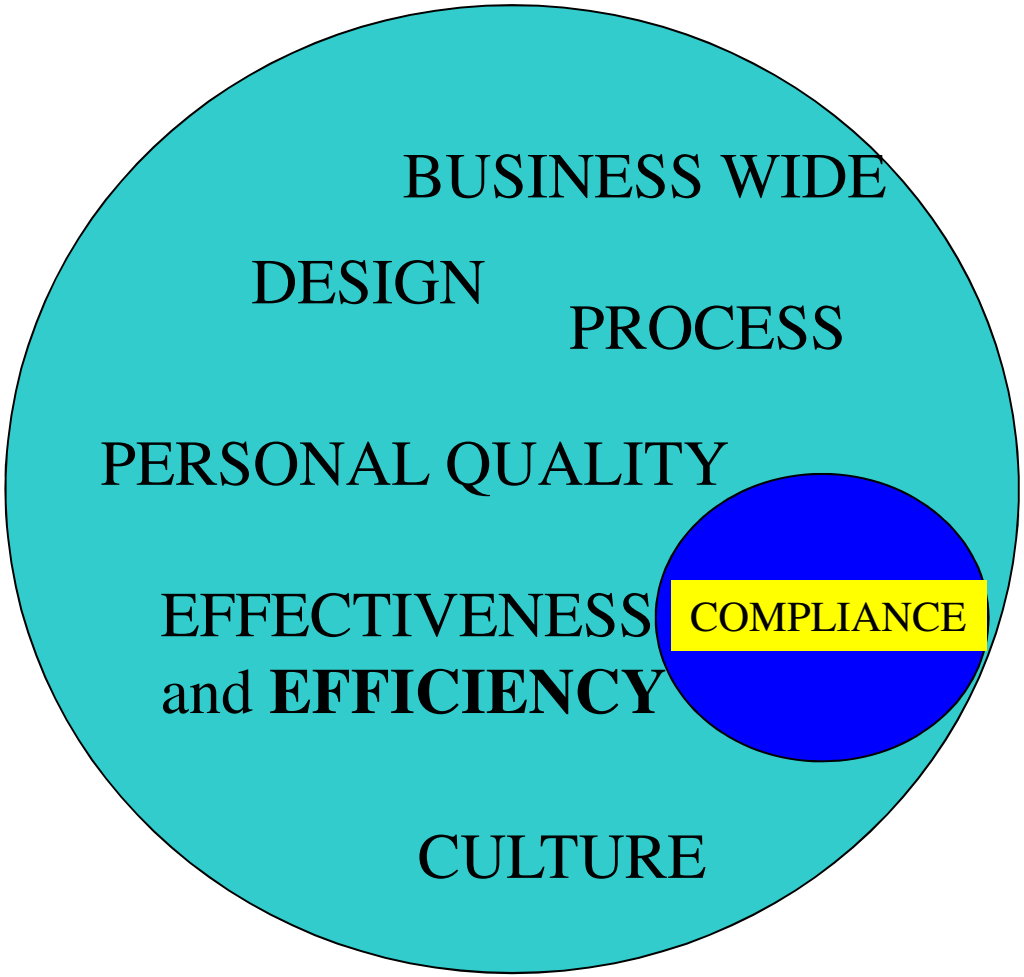
THE BIG Q



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ICH Q10 OVERVIEW

- **Based on ISO quality concepts**
- **Includes GMP requirements**
- **Complements ICH Q 8, Pharmaceutical Development**
- **Complements ICH Q 9, Quality Risk Management**

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Intends to encourage innovation, continual improvement, the use of science and risk-based approaches.

Expects process controls, monitoring and performance indicators.

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Develop and use effective monitoring and control systems for process performance and product quality, thereby providing assurance of continued suitability and *capability* of processes.

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MANAGEMENT RESPONSIBILITY

Senior management has ultimate responsibility for the System.

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MANAGEMENT IS THE PROBLEM
MANAGEMENT IS THE SOLUTION

- Lack of processes/systems for managing the QS
- Short term focus
- Reliance on QA department for managing the QS

Lack of knowledge

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Management should:

ICH Q10

1. Participate in the design, implementation, monitoring and maintenance of the System.

2. Demonstrate strong and visible support.

3. Establish appropriate communication processes. Ensure that an escalation process exists to raise quality issues to the appropriate levels of management.

4. Define roles, responsibilities, authorities and interrelationships.

5. Conduct management reviews. Continuous improvement is a goal of this review.

6. Advocate continual improvement.

7. Provide appropriate resources.

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MANAGEMENT REVIEW

Exercise

Who should be the leader?

Who should participate?

What data should be reviewed?

How often should the team meet?

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Management Review of QS

The review should include assessment of performance indicators that can be used to monitor the effectiveness of processes within the quality system.

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ICH Q10

THE QUALITY MANUAL

The Quality Manual should include the sequences, linkages and interdependencies of the system processes and management responsibilities.

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QUALITY PLANNING

Senior management should ensure the quality objectives are defined and communicated.

Management should provide resources and *training* to achieve objectives.

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ENABLERS

Knowledge Management: product and process

Risk Management: It is *integral* to an effective quality system. It can provide a proactive approach to identifying, scientifically evaluating, and controlling potential risks to quality.

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KNOWLEDGE MANAGEMENT

Knowledge Management is a systematic approach to acquiring, analyzing, storing, and disseminating information related to products, manufacturing processes and components.

Product and process knowledge should be managed throughout the life cycle.

Sources of knowledge - prior knowledge, development studies, technology transfer, process validation studies over life cycle, manufacturing experience, innovation, continual improvement, and change management

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Knowledge Management

***Explicit* knowledge** can be expressed in words and numbers and shared in the form of data, scientific formulae, specifications manuals and the like. This kind of knowledge can be readily transmitted across individuals formally and systematically.
***Tacit* knowledge** on the other hand, is highly personal and hard to formalize, making it difficult to communicate or share with others. Subjective insights, intuitions, and hunches fall into this category of knowledge. Difficult to verbalize, such tacit knowledge is deeply rooted in an individual's action and experience as well as in the ideals, values or emotions he or she embraces.
(N. Calnan)

Knowledge Management

Today the emphasis is on control.

The principal challenge is the use of the knowledge. How to establish a culture that facilitates the use and sharing of knowledge.

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Knowledge Management

What is the linkage between knowledge management and quality risk management?

How can we better use tacit knowledge?

What are the obstacles to knowledge accumulation and use?

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Knowledge Management

Let’s share our ideas on knowledge management.

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The design of the PQS should incorporate appropriate risk management principles.

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SYSTEM ELEMENTS

1. Process performance and product quality monitoring system.
   - Use data management and statistical tools.
   - Use risk management to establish control strategy.
   - Acquire knowledge to enhance process understanding.

2. Corrective and Preventive Action:
   - Determine root cause
   - Level of effort and documentation should be commensurate with the level of risk.

3. Change Management:
   - Ensures continual improvement.
   - Risk management should be used to evaluate changes.
   - The level of effort of the evaluation should be commensurate with the level of risk.

4. Management Review

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ICH Q 10 - DATA

Performance indicators should be identified and used to monitor the effectiveness of processes within the quality system.

Performance indicators that measure progress against quality objectives should be established, monitored, communicated regularly, and acted upon as appropriate.

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Process Performance and Product Quality Monitoring

Purposes:

- **Ensure state of control is maintained**
- **Identify areas for continual improvement**

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Outsourced Activities and Purchased Materials

1. **Assess suitability of supplier**

2. **Define responsibilities and communication processes. (written agreement)**

3. **Monitoring and implementation of improvements**

4. **Assuring that incoming materials are from approved sources**

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V. Continual Improvement of the Pharmaceutical Quality System (PQS)

A. Management Review of the PQS

B. Monitoring of Internal and External Factors That Can Have an Impact on the PQS.

C. Outcomes of Management Review and Monitoring.

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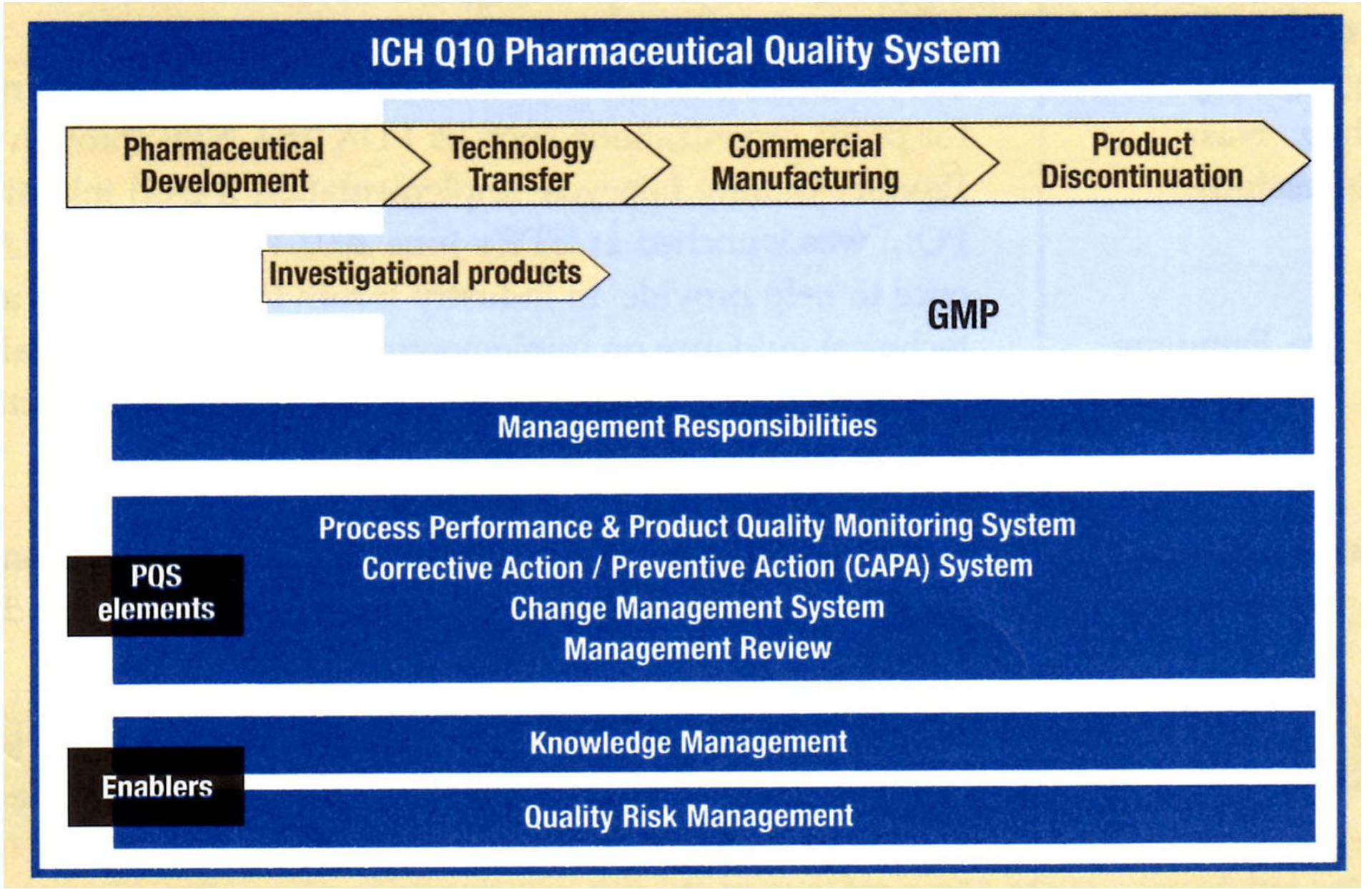
ICH Q10 Pharmaceutical Quality System
Pharmaceutical Development
Technology Transfer
Commercial Manufacturing
Product Discontinuation
Investigational products
GMP
Management Responsibilities
PQS elements
Process Performance & Product Quality Monitoring System
Corrective Action / Preventive Action (CAPA) System
Change Management System
Management Review
Enablers
Knowledge Management
Quality Risk Management

MANAGEMENT IS THE PROBLEM
MANAGEMENT IS THE SOLUTION

- **Put in place processes to manage the QS. Review KPIs monthly.**
- **Develop a long range quality strategic plan**
- **Strengthen QA - empower and increase know-how**

Invest in the development of your employees.

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Some “deficiencies” in ICH Q10:

Does not discuss efficiency and costs.

Changes do not always need to be
“evaluated by expert teams”

Does not define system.

Does not emphasize process - their inter linkage, thinking and management

List of system components is incomplete -
training, validation, culture, etc.

Not sufficient for Operational Excellence or World Class

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CHANGE MANAGEMENT

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“QRM should be utilized to evaluate proposed changes. The level of effort and formality of the evaluation should be commensurate with the level of risk.”

“Proposed changes should be evaluated by expert teams….”

Is there a contradiction?

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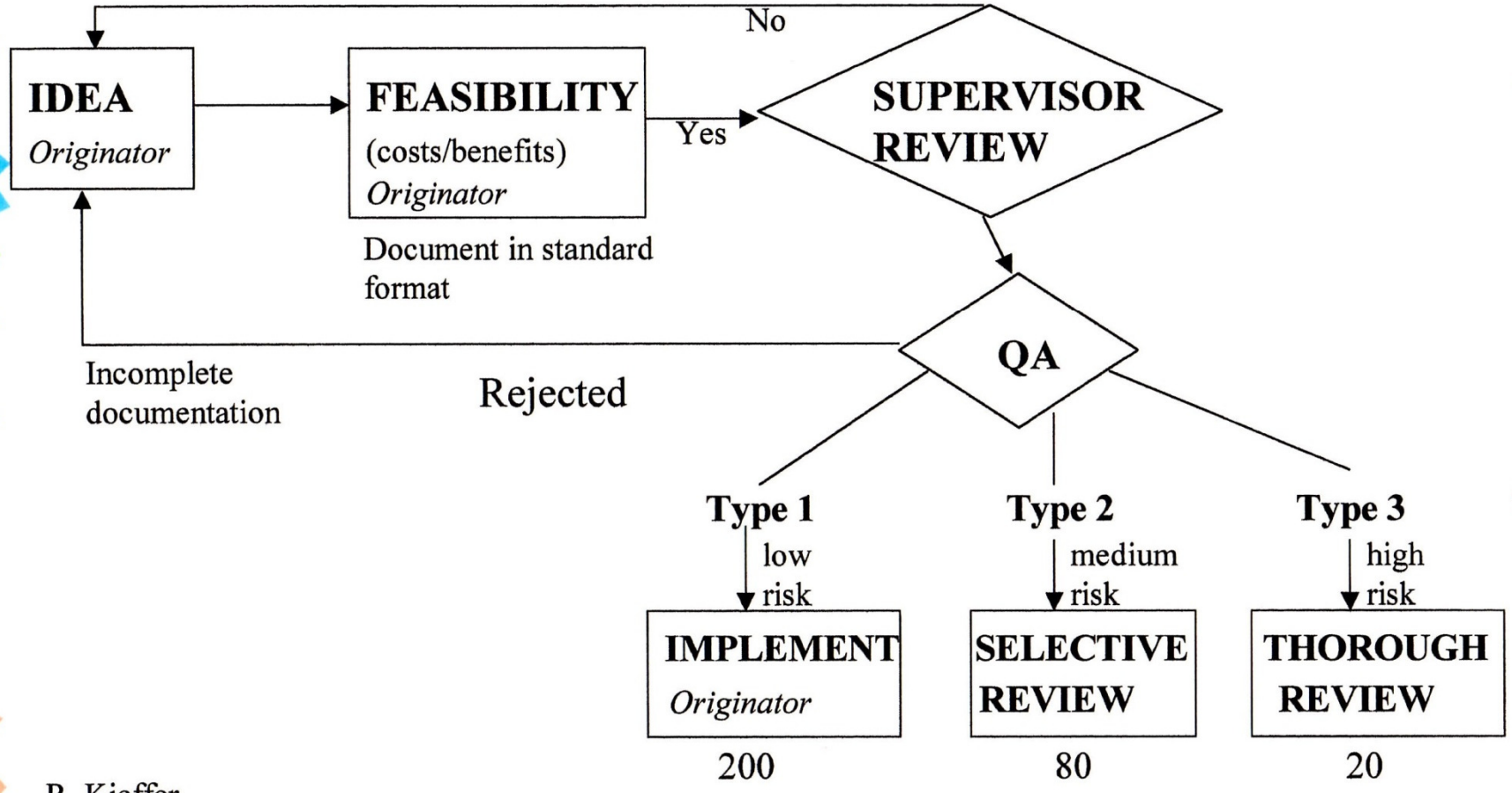
CHANGE CONTROL

Purpose: assure product quality, facilitate cont. improvement

Process capacity requirement: 300 changes/mo.

Design considerations: perform work up front, not all changes are equal (filters)



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IMPLEMENTATION ISSUES

1. **Requires a paradigm shift in thinking, in the culture. Our industry is slow to change.**

2. **Requires new learning. Our industry does not invest much in training.**

3. **Requires a long term focus.**

4. **Incompatibility with FDA's 6 systems and structure of GMPs**

5. **Requires time and new learning for senior management, quality managers and the regulators.**

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PROCESS

A Process Oriented Organization

Process Management

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If we had to select the action that tends to make the greatest contribution to lasting Process Management, it would be the appointment of a process owner for each key process.
(Rummler - Brache)

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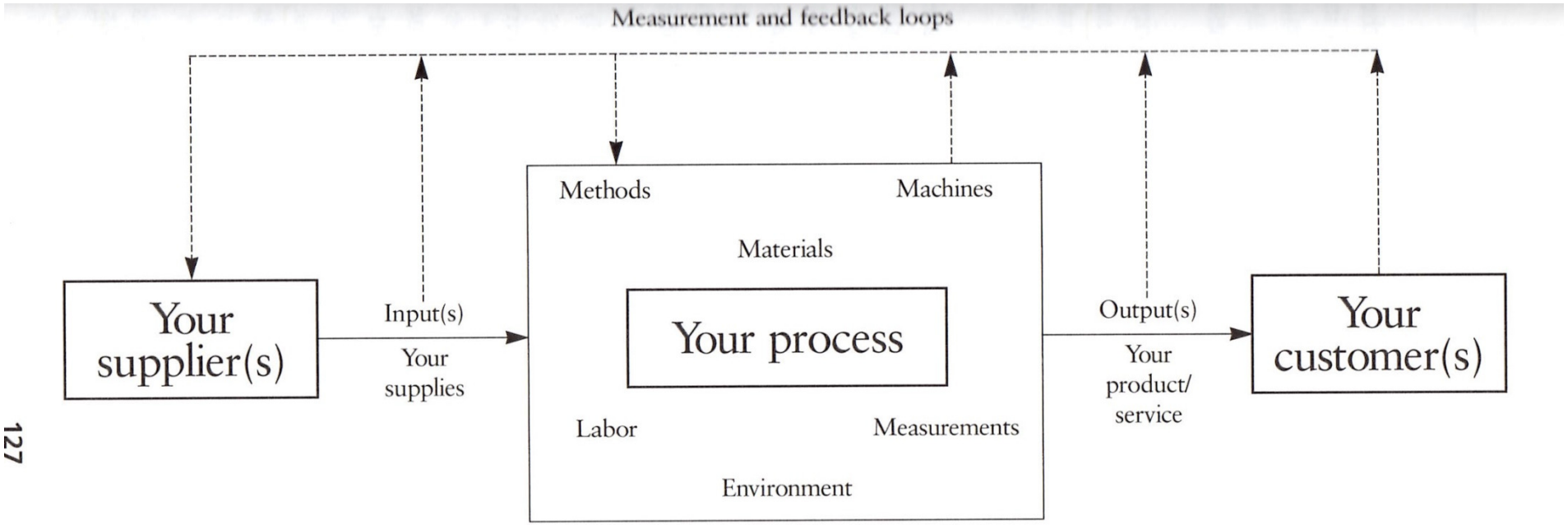

Techniques/methods

- Requirements/ specifications
- Expectations

- Design
- Conformance
- Delivery
- Cost

- Define the process
- Measure/assess the process
- Improve the process
- Control the process

- Design
- Conformance
- Delivery
- Cost

- Requirements/ specifications
- Expectations

PROCESS

1. **Focus on the process is the way to improve quality and at the same time reduce cost.**

2. **Understanding the process is an essential prerequisite for performing a risk analysis.**

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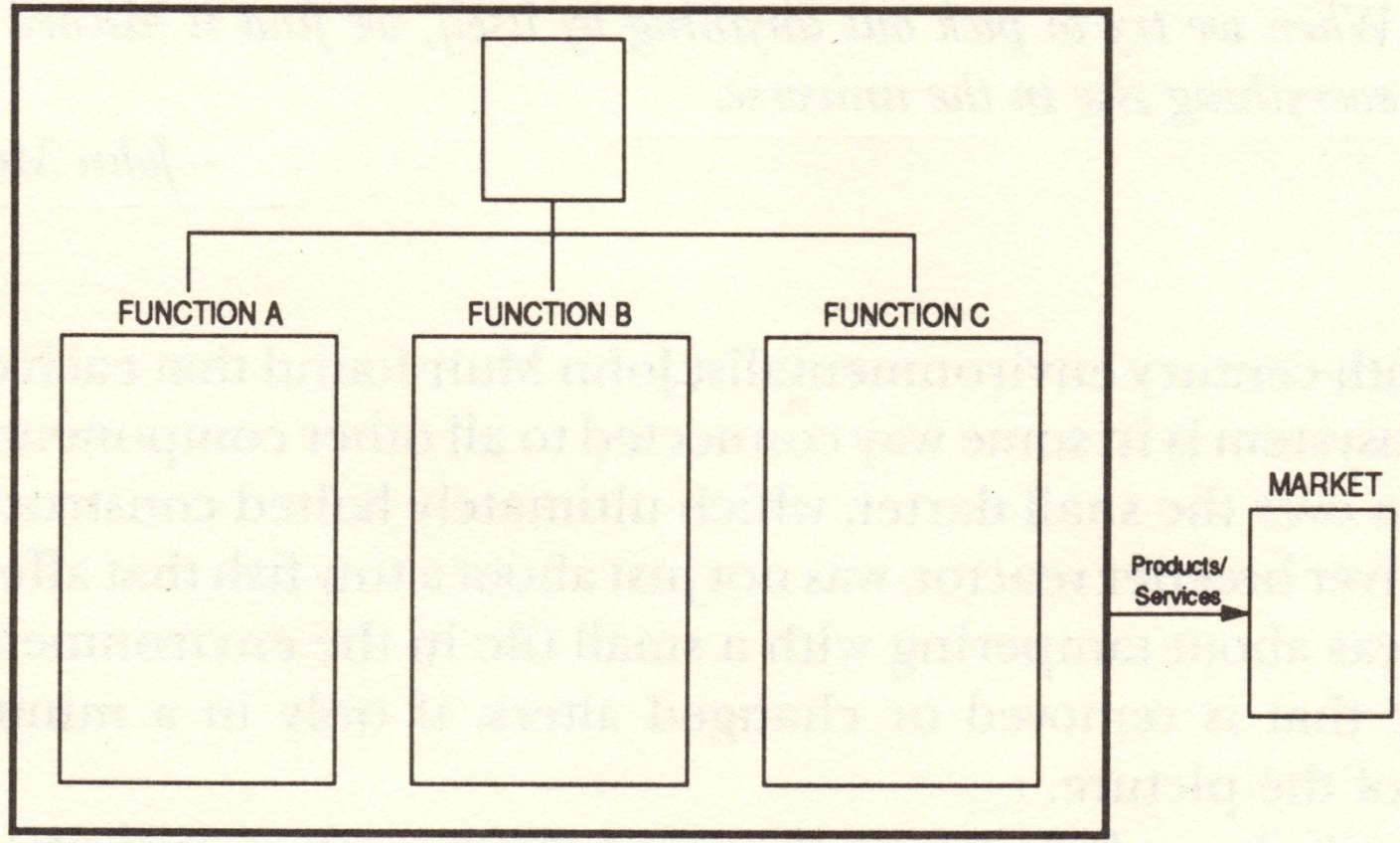
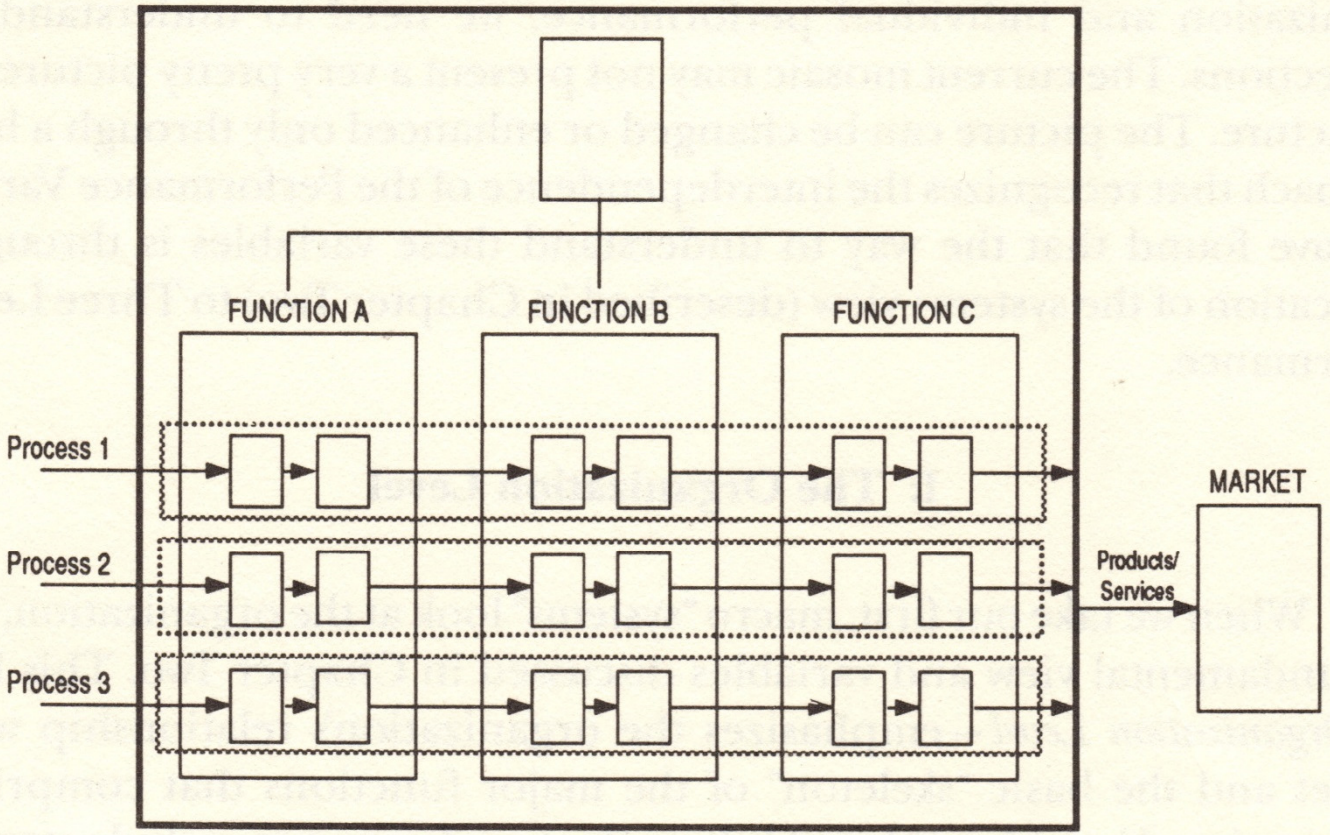
Figure 3.1. The Organization Level of Performance.



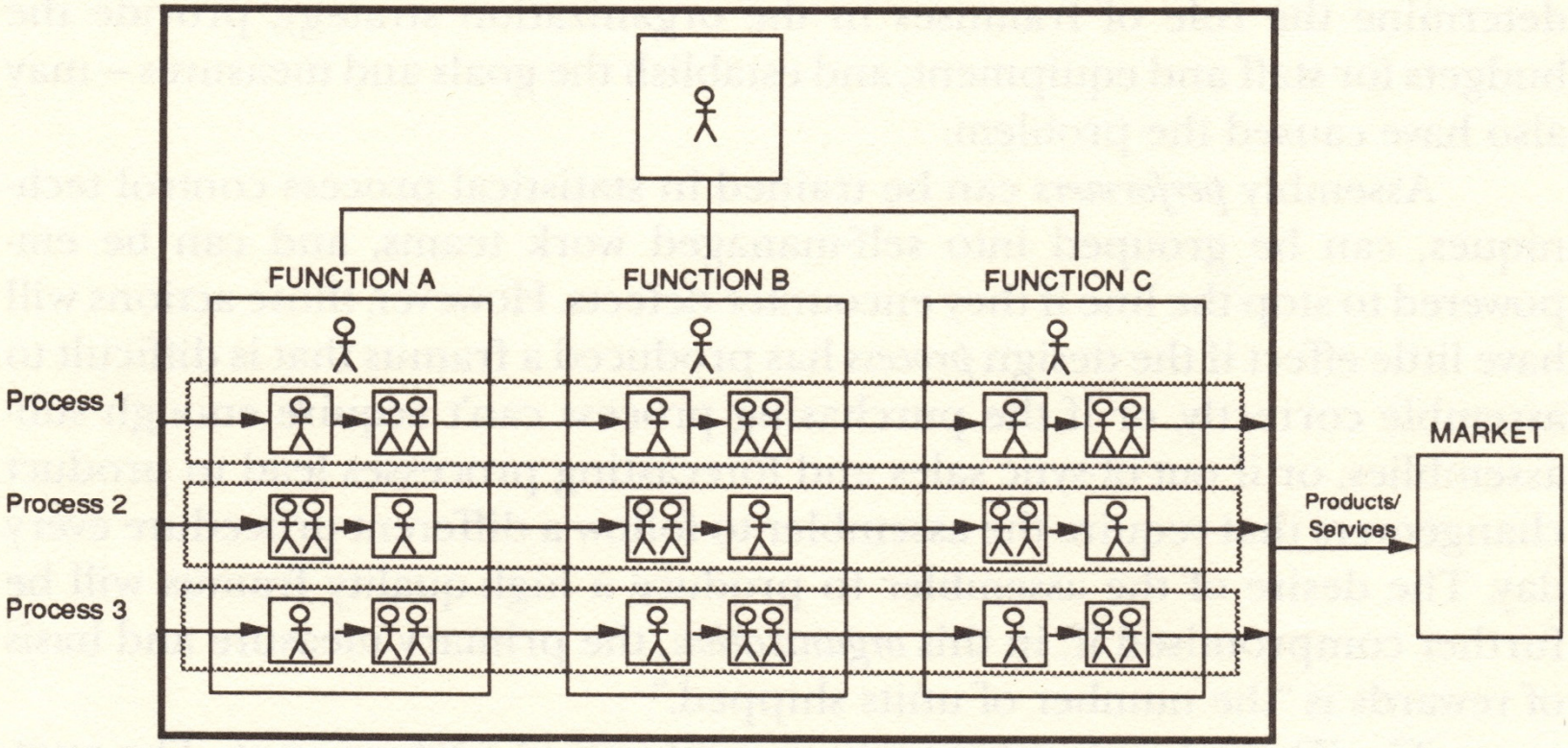
Rummler - Brache

Figure 3.2. The Process Level of Performance.



Rummler - Brache

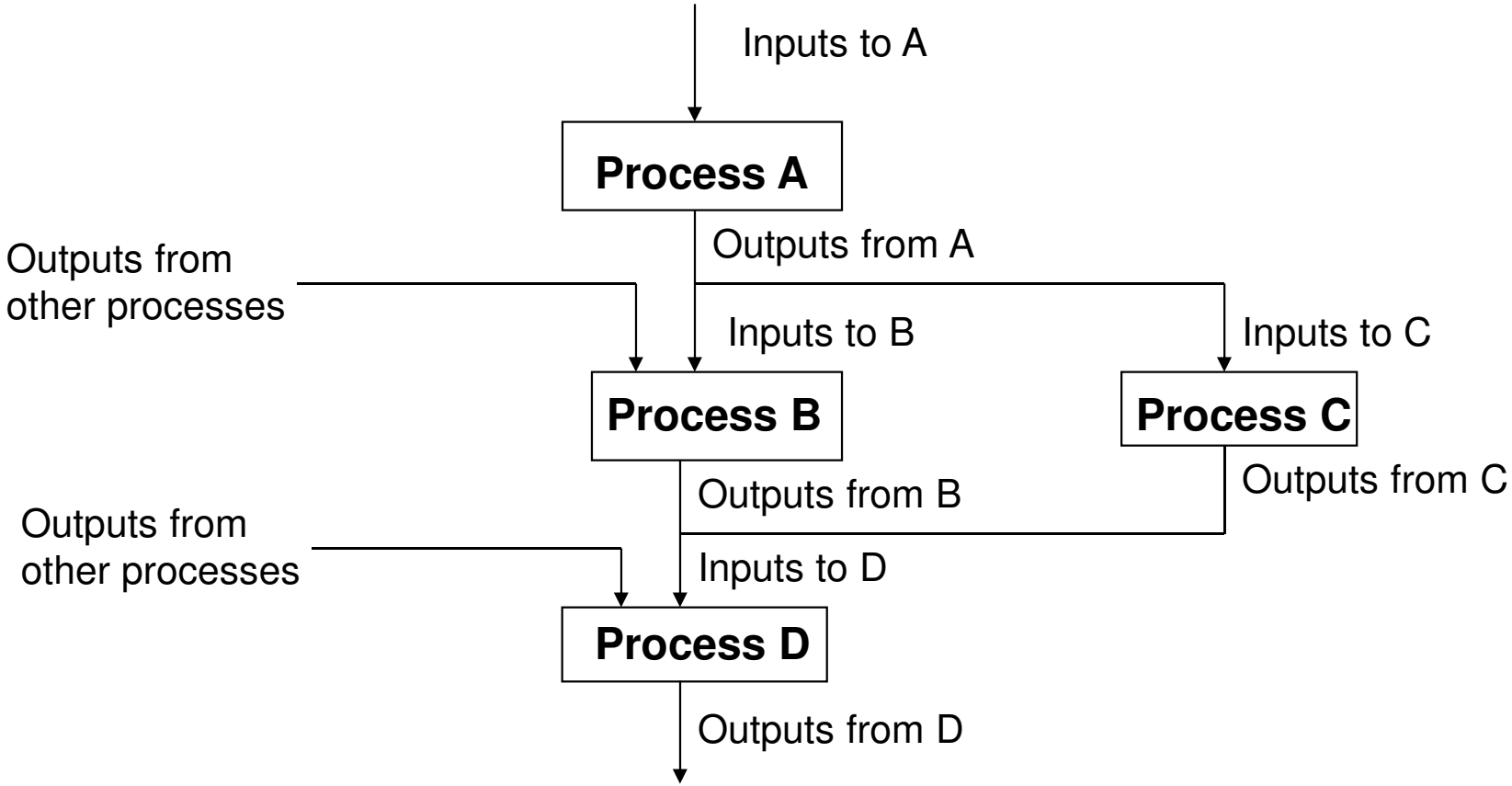
Figure 3.3. The Job/Performer Level of Performance.



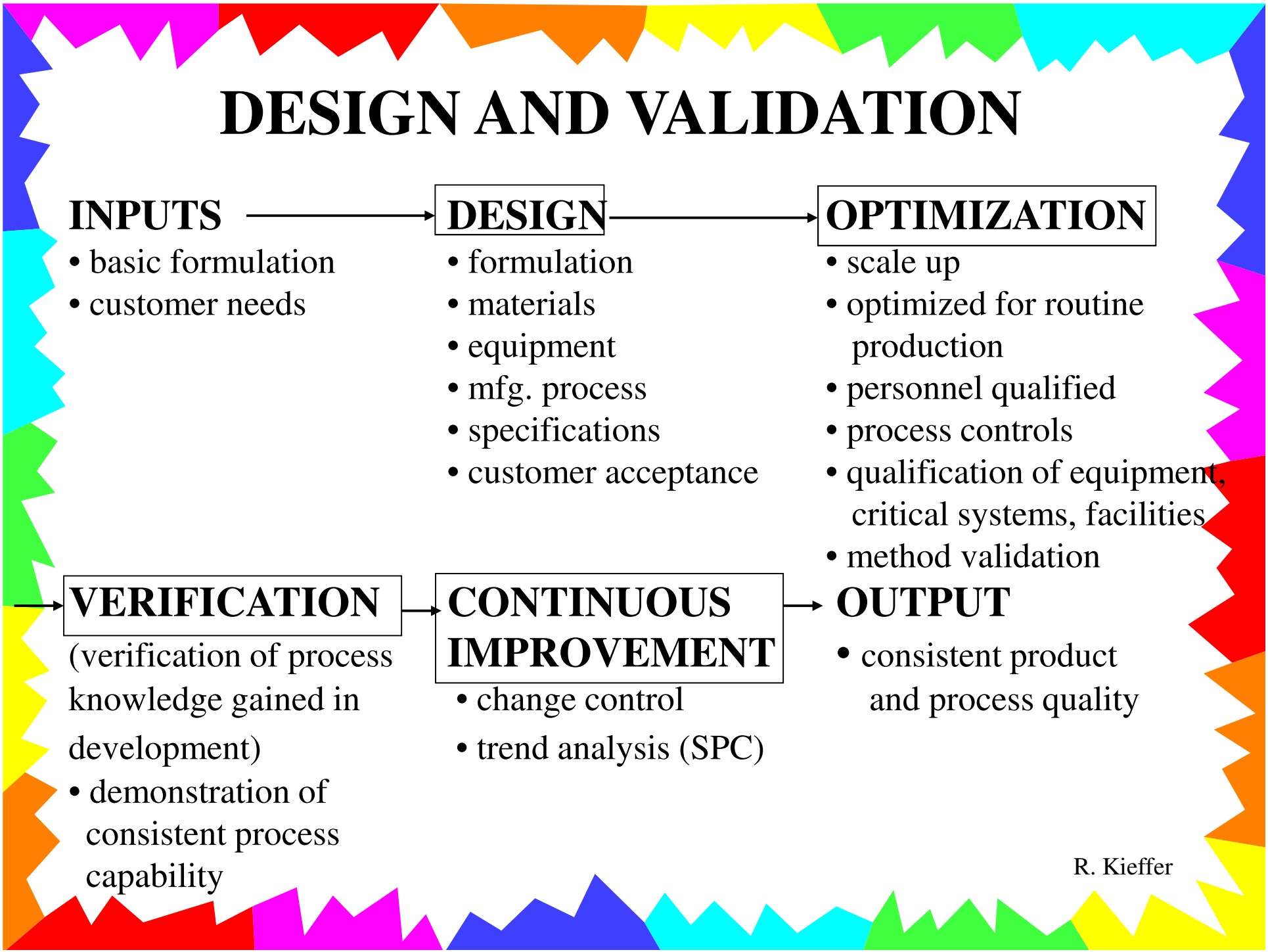
Rummler - Brache

PROCESS INTERLINKAGE

The outputs from one process may be the inputs to other processes and interlinked into the overall system.



DESIGN AND VALIDATION



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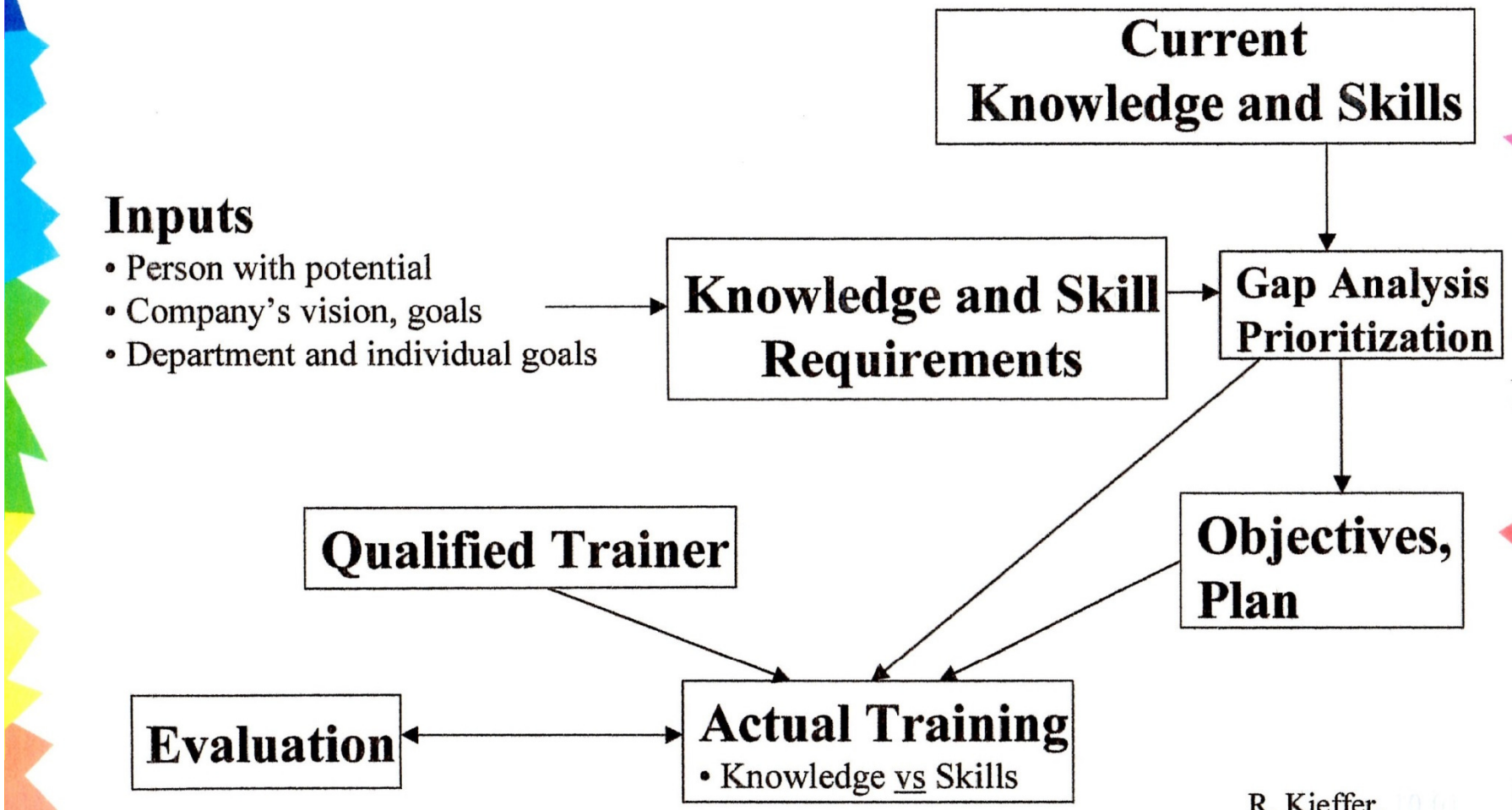
TRAINING PROCESS



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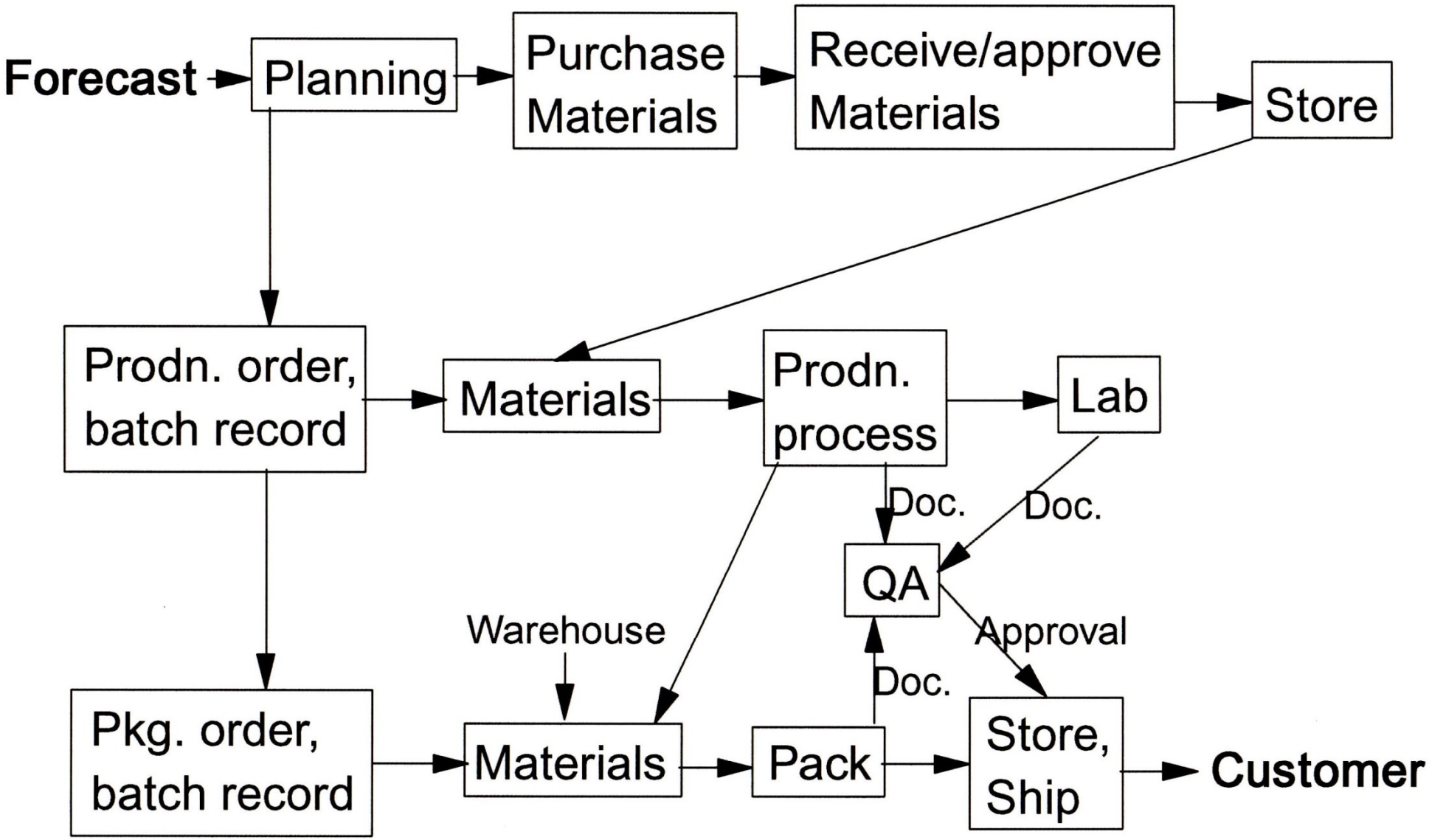
MATERIALS MANAGEMENT



GOAL

All components are integrated, aligned and managed as a system.

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PROCESS METRICS

- cost
- volume
- current, up-to-date
- cycle time
- right first time
- customer satisfaction

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PROCESS OWNER

- Facilitate design of process
- Train process users
- Monitor process performance (metrics)
- Report process performance to senior management
- Continuously improve the process

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PROCESS AND HUMAN ERROR

What do you think is the connection?

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THE HUMAN ELEMENT

Frequently, the steps in the process that involve human intervention are the weakest links in the process – the steps with the highest risk.
This is generally due not to lack of training or motivation of the worker, but to weaknesses in the design of the process and to the intrinsic failure rate of manual operations.

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BEYOND ICH Q10 - BEYOND COMPLIANCE

TO

OPERATIONAL EXCELLENCE - WORLD CLASS

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“The real story is about the path to consistent quality coupled to high efficiency.”

“For the industry to continue to be successful, drug manufacturing must be agile, rapidly scalable, efficient, reliable - and less costly.”

Janet Woodcock, Dir. Center for Drug Evaluation and Research, “Flawless”, 2014

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TODAY?

Are you better today than 5 years ago? Do you have the data to prove it?

Based on your validation studies are you able to reduce finished product testing?

Have repeat failures reduced from year to year?

Do you have a long term strategic plan for quality?

Have you shifted from department management to process management?

Are your processes designed to minimize errors? Are they efficient?

Do you measure waste in all its forms? (In general waste in our industry is over 25%.)

Does production take responsibility for product quality.

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TODAY

Has QA shifted from policing to process improvement (prevention) and promoting quality?

Is quality equated with compliance?

Are statistical, quality, risk, 6 sigma, lean etc. tools used routinely?

What is your maturity score? (See ISO 9004)

Is cross-functional collaboration, teamwork, working well?

Are specifications, process limits set based on science?

Is our focus on quality by design or on quality by inspection?

.
.
.
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Today

"We produce 6-sigma products from 3-sigma processes."
(*Gerry Migliaccio*)

How?

By the application of very costly and less reliable Quality by Inspection practices.

RFT - Pharm. Ind. = 85-95%; World Class = 99.4%
(K. van Nes)

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Today

"Even as it invents futuristic new drugs, its manufacturing techniques lag far behind those of potato-chip and laundry-soap makers."

"other high-tech industries….have achieved enormous productivity gains in manufacturing in the last 25 years. We should expect nothing less from the pharmaceutical industry." (Dr. McClellan, FDA Commissioner)

Abboud, L. and Hensley, S. New Prescription for drug makers: Update the plants. Wall Street Journal, 2003, September 3.

(Calnan)

WASTE

Definition:

- **Non-value-added activities**
- **Process output not wanted by customer**
- **Resources used because not right first time**

Examples:

- **Rejects, recalls, low yields, consent decrees,**
- **Training without improved performance**
- **Validation without process improvement**
- **Meetings**
- **Emails**
- **Not right first time - investigations, checks, etc.**
- **Focus on low risk problems - audits, CAPA**
- **Reviews, signatures (2 max.)**
- **Risk analysis - no process improvement**

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Quality is free. It's not a gift, but it's free. What costs money are the un-quality things - all the actions that involve not doing the job right the first time.
(Philip Crosby)

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OPERATIONAL EXCELLENCE
WORLD CLASS

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OPERATIONAL EXCELLENCE

Definitions:

- **OPEX is an element of organizational leadership that stresses application of a variety of principles, systems and tools toward the sustainable improvement of key performance metrics. Lean Manufacturing, Six Sigma. Long term change in organizational culture. (Wikipedia)**

- **Each and every employee can see the flow of value to the customer, and fix that flow before it can break down. (Inst. for OPEX)**

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OPEX Definitions

Operational Excellence

- The organization has the capability to continuously improve all areas of the operation for greater efficiency and effectiveness.
  - Unification of management
  - Visualize key processes
  - Design process workflow
  - Process controls and metrics
  - Make process changes as necessary
  - Drive continuous improvement (Don't forget breakthrough improvements.)
  - Culture of risk management
- Use quality tools and techniques such as six sigma. Use of statistical tools.

(Calnan)

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Schuh & Company
OPEX in the Pharmaceutical Industry

- **Significant savings through OPEX**
  - **improved productivity**
  - **reduced defects**
  - **higher capability**
  - **reduced variation**
  - **shorter lead times**
  - **lower inventories**
  - **reduced waste**
  - **etc.**

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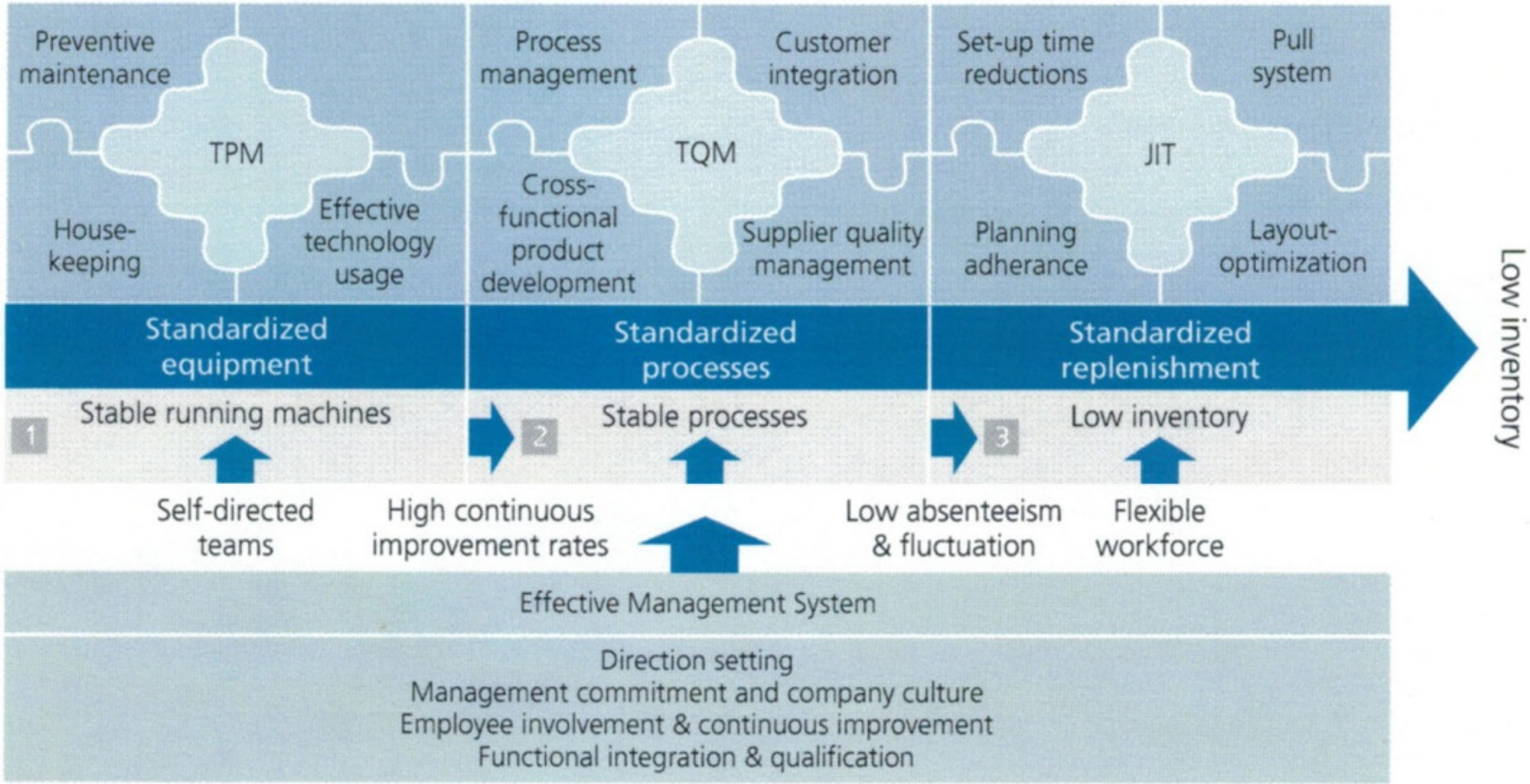

The University of St. Gallen OPEX Reference Model

The Anatomy of Operational Excellence by Faisal Hogue

OPEX enables an enterprise and its leadership to continuously improve all areas of performance , including decision-making, ongoing investment, profitability, customer and partner services and human resources capabilities. Operationally excellent enterprises possess the processes and structures that give them the visibility, control, tools and management practices necessary to drive greater operational effectiveness and efficiency.

Roadmap:

1. **Visualize key operational processes**
2. **Design workflow for each key process**
3. **Develop metrics**
4. **Manage process**
5. **Drive continuous improvement**

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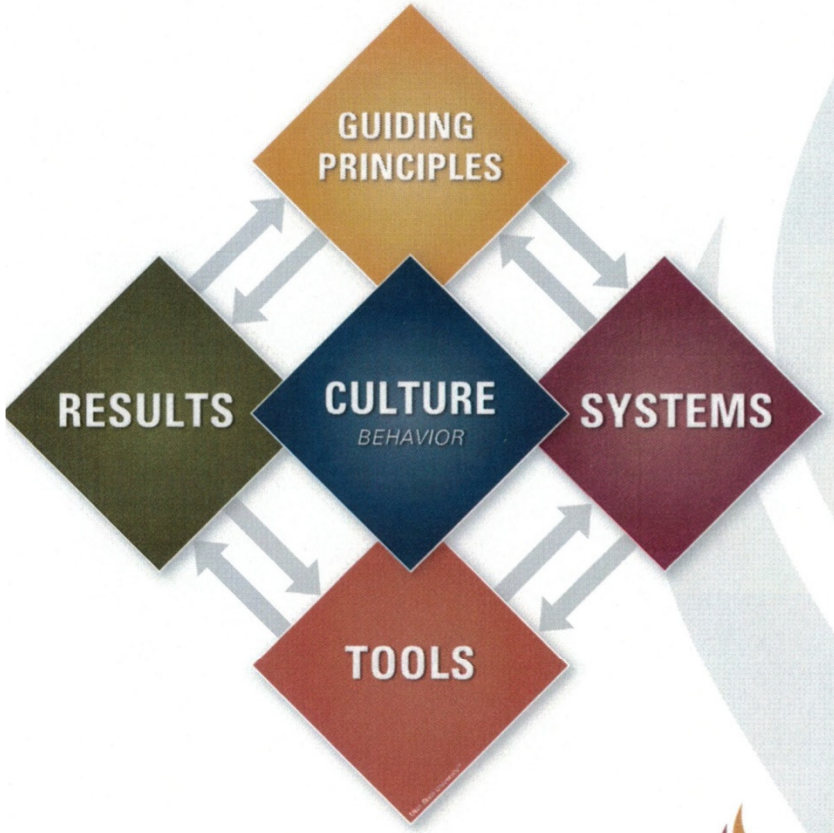
THE SHINGO MODEL™



THE GUIDING PRINCIPLES

THREE INSIGHTS OF ENTERPRISE EXCELLENCE™

1. Ideal Results Require Ideal Behavior
2. Beliefs and Systems Drive Behavior
3. Principles Inform Ideal Behavior

SHINGO INSTITUTE

HOME OF THE SHINGO PRIZE

Shingo

For any organization to be successful in the long term, it must engage in a relentless quest to make things better.

Continuous pursuit of perfection.

Requires great leaders, smart managers and empowered associates.

Culture where every single person is engaged every day in making small, and from time to time large, changes.

Ultimately, the results of an organization are dependent on the way their people behave.

(www.shingoprize.org)

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BEHAVIORS OF CLASS A COMPANIES

1. One set of numbers
2. Shared, aligned and realistic plans
3. Accurate data and facts
4. Simplification
5. Process performance measures
6. “Democracy” in planning, “Autocracy” in execution
7. Common set of plans and assumptions, but open to new input
8. Accountability and speaking up
9. Knowledgeable workforce with clear goal and responsibilities

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The Oliver Wight ABCD Checklist for Operational Excellence

- **Are we integrating people, processes and tools?**
- **Are we comparing performance against established best practices?**

- **There are significant risks in trying to do too much at one time.**

Strategic Planning

Class A: Strategic planning is an ongoing process. It provides direction to all elements of the company and drives decisions and actions. Employees at all levels can articulate and share the company's vision and its overall strategic direction.
They can also articulate their roles in the implementation and execution of the strategic plan.
Class B: Formal process performed by management at least once a year.
Class C: Infrequent strategic planning.
Class D: Strategic Planning is nonexistent.

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Overview - Strategic Planning Processes

1. Commitment to Excellence
2. Leadership Team
3. Vision and Mission
4. Business Performance Assessment
5. Analysis of External Environment and Internal Capabilities
6. Case for Change
7. Strategy Creation
8. Establishing Strategic Goals
9. People and Communications
10. Business Plan Integration
11. Goal Deployment and Implementation
12. Measure Results
13. Diagnosis and Review
14. Reflection
15. Ongoing, Formal Goal Setting and Strategic Planning
16. Education and Training

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OVERVIEW ITEMS

1-1 COMMITMENT TO EXCELLENCE

The company has an obsession with excellence and is not satisfied with the status quo. Executives provide the leadership necessary for change. They articulate the motivations for positive change and communicate them throughout the organization—by actions as well as words.

1-2 LEADERSHIP TEAM

The organization has a leadership team consisting of key executives who recognize they must sponsor and guide the members of the organization by taking a forward position and acting on key issues.

1-3 VISION AND MISSION

Vision and mission statements for the organization exist. The vision statement focuses on the future of the business and shows employees, shareholders, and customers what the company wants to become. The mission statement outlines the purpose and nature of the business and reinforces the reason for its existence; These items include statements on products and/or services, customers, community, and employees. They are a broad road map of where the company wants to be in the future and do not contain specific operational or financial measurements.

1-4 BUSINESS PERFORMANCE ASSESSMENT

A process exists that assesses the company's business performance in the four areas of success (measures of success): customer satisfaction, shareholder/stakeholder satisfaction, employee satisfaction, and community satisfaction.

R. Kieffer

Oliver Wight

1-5 ANALYSIS OF EXTERNAL ENVIRONMENT AND INTERNAL CAPABILITIES

Assessment processes, using facts and data, exist to determine how well the organization is performing with respect to all of the key drivers within the measures of success.

1-6 CASE FOR CHANGE

When the assessment of business performance indicates the existence of threats, opportunities, and/or the necessity for improvement, a case for change is presented to all employees of the company.

1-7 STRATEGY CREATION

The strategic planning process is initiated by Top Management and represents input from key people throughout the organization. Each and every strategy is documented and is linked to and supports the strategic goals.

1-8 ESTABLISHING STRATEGIC GOALS

Strategic goals are recognized as ends to which efforts are to be directed. Strategic goals require significant changes in the way in which the business operates and may take several years to implement.

1-9 PEOPLE AND COMMUNICATIONS

It is recognized that the successful implementation of strategies is a direct function of people involvement and continuous communication.

1-10 BUSINESS PLAN INTEGRATION

All goals and strategies are integrated into the business plan, which is used to develop and communicate annual financial plans that incorporate input from all operating departments of the company.

R. Kieffer

Oliver Wight

1-11 GOAL DEPLOYMENT AND IMPLEMENTATION

A process exists whereby the strategies and goals are deployed throughout the organization to gain focus, alignment and engagement throughout the company.

1-12 MEASURE RESULTS

It is recognized that strategic goals and strategies are deployed from management throughout the organization and that results are reported from the organization to management. A process exists to monitor progress against plans and to take corrective action when needed.

1-13 DIAGNOSIS AND REVIEW

Systematic reviews are done throughout the year to determine how annual goals are being achieved. These reviews include: methods employed, study of data, and comparison of plans against activities and plans against results.

1-14 REFLECTION

Executive management, individually or as a group, dedicates time to reassess the logic of their strategies and related goals and their achievements.

1-15 ONGOING, FORMAL GOAL SETTING AND STRATEGIC PLANNING

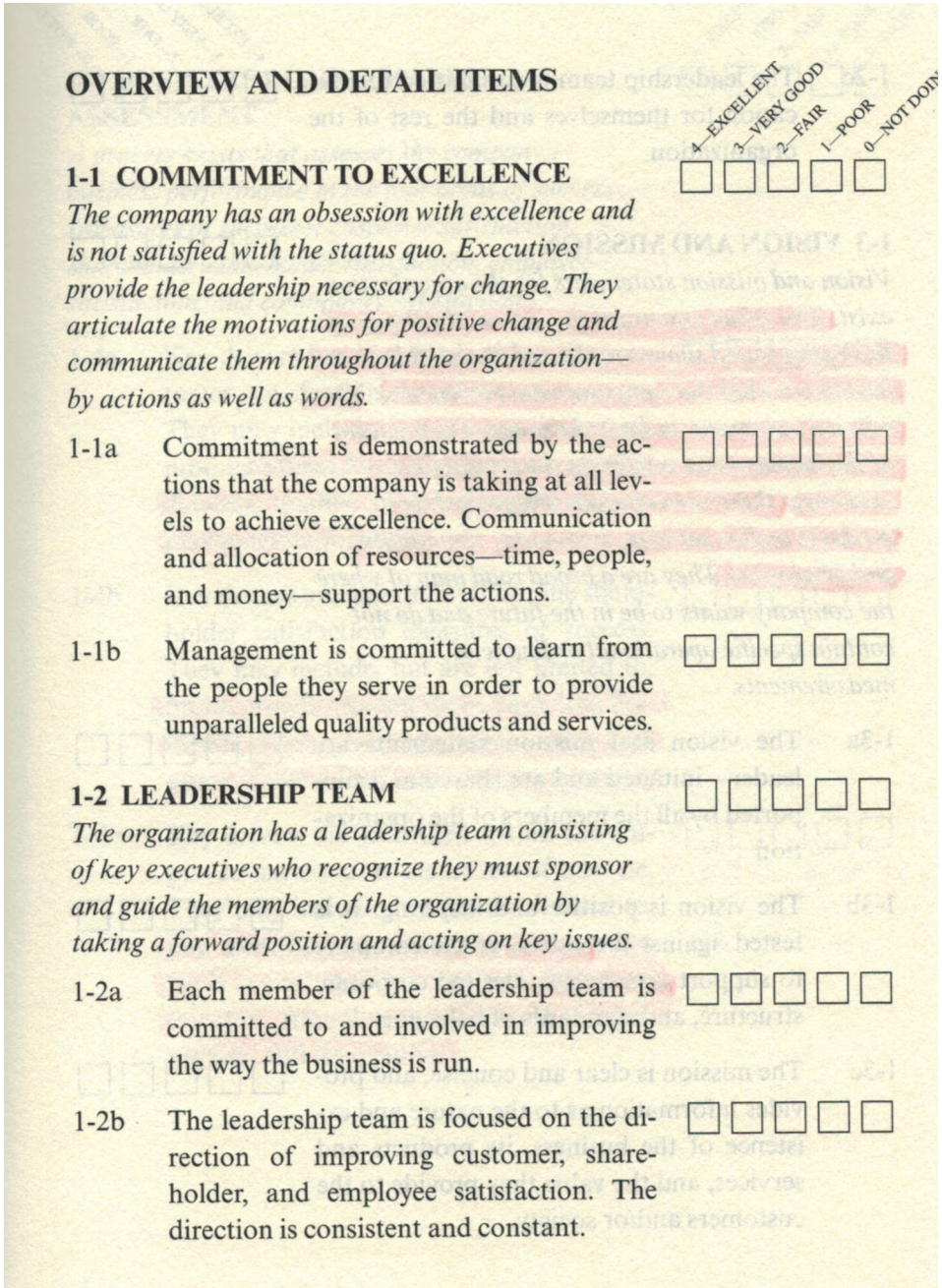
Goal setting and strategic planning are part of a formal process in which all executive managers have active, visible leadership roles.

1-16 EDUCATION AND TRAINING†

Education and training is viewed as a strategic advantage and the knowledge gained is measured by successful application on the job.

R. Kieffer

Oliver Wight



OVERVIEW AND DETAIL ITEMS

4—EXCELLENT 3—VERY GOOD 2—FAIR 1—POOR 0—NOT DOIN

1-1 COMMITMENT TO EXCELLENCE

The company has an obsession with excellence and is not satisfied with the status quo. Executives provide the leadership necessary for change. They articulate the motivations for positive change and communicate them throughout the organization—by actions as well as words.

1-1a Commitment is demonstrated by the actions that the company is taking at all levels to achieve excellence. Communication and allocation of resources—time, people, and money—support the actions.

1-1b Management is committed to learn from the people they serve in order to provide unparalleled quality products and services.

1-2 LEADERSHIP TEAM

The organization has a leadership team consisting of key executives who recognize they must sponsor and guide the members of the organization by taking a forward position and acting on key issues.

1-2a Each member of the leadership team is committed to and involved in improving the way the business is run.

1-2b The leadership team is focused on the direction of improving customer, shareholder, and employee satisfaction. The direction is consistent and constant.

R. Kieffer

Oliver Wight Checklists and Classifications (A,B,C,D)

1. **Strategic Planning Processes**
2. **People/Team Processes**
3. **Total Quality and Continuous Improvement Processes**
4. **New Product Development Processes**
5. **Planning and Control Processes**

R. Kieffer

MALCOLM BALDRIGE
CRITERIA FOR PERFORMANCE EXCELLENCE

1. **Leadership (120)**
2. **Strategic Planning (85)**
3. **Customer Focus (85)**
4. **Measurement, Analysis, and Knowledge Management (90)**
5. **Workforce Focus (85)**
6. **Operation Focus (85)**
7. **Results (450)**

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Malcolm Baldrige

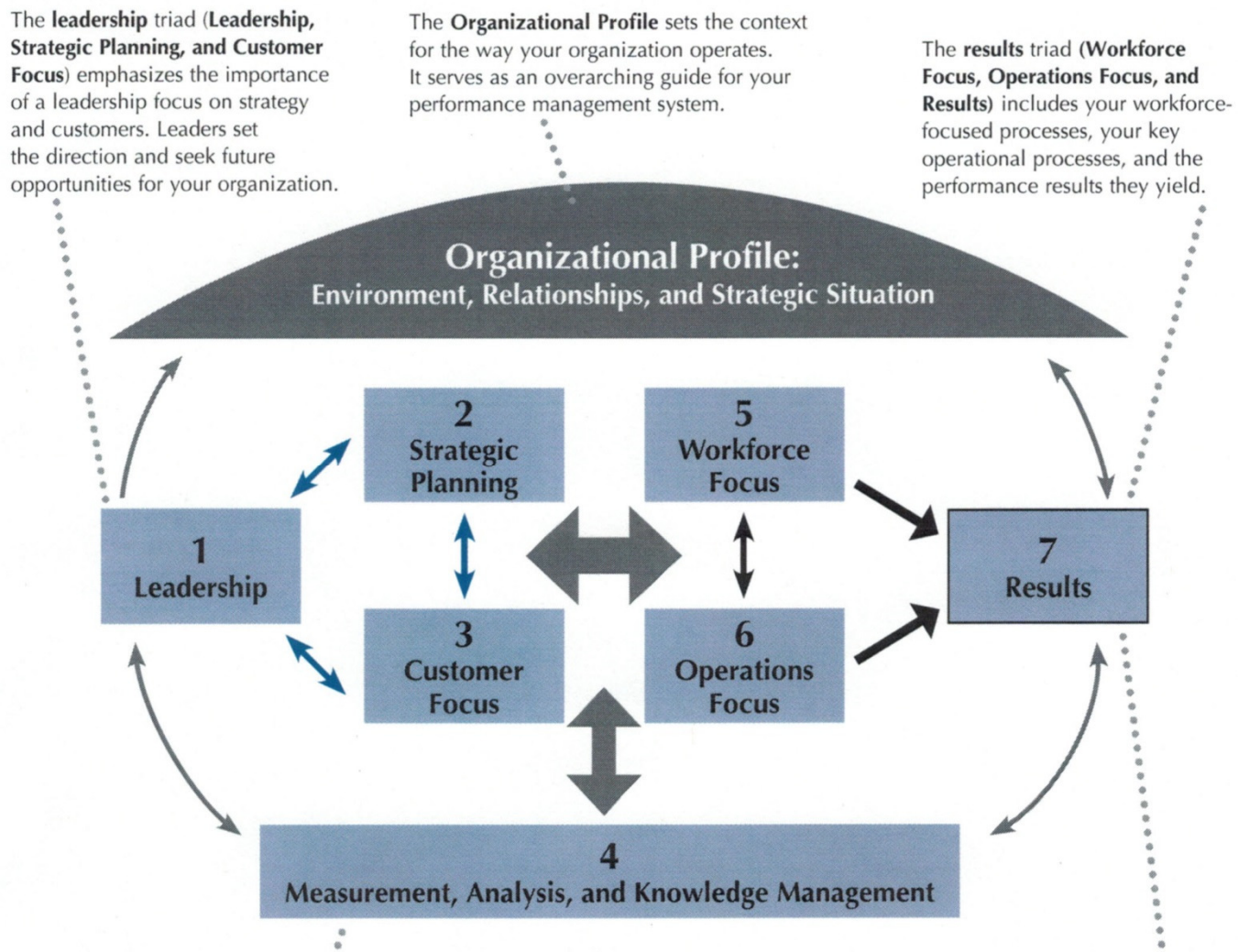
The criteria support a systems perspective to align goals across your organization.

Focus on results.

The criteria support goal-based diagnosis. (self assessment)

R. Kieffer

MB System Perspective



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MB Scoring

Process:
- **Approach**
- **Deployment**
- **Learning**
- **Integration**

Results:
- **Levels**
- **Trends**
- **Comparisons**
- **Integration**

R. Kieffer

Malcolm Baldrige

From Fighting Fires to Innovation: An Analogy for Learning

Learning is an essential attribute of high-performing organizations. Effective, well-deployed organizational learning can help an organization improve from the early stages of reacting to problems to the highest levels of organization-wide improvement, refinement, and innovation.

1

Reacting to the problem (0–5%)

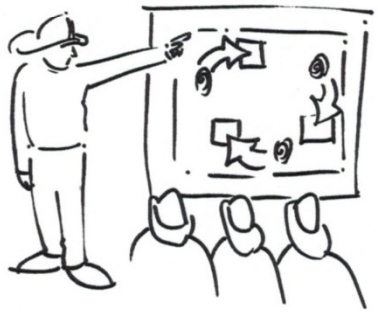
Run with the hose and put out the fire.

2

General improvement orientation (10–25%)

Install more fire hoses to get to the fires quickly and reduce their impact.

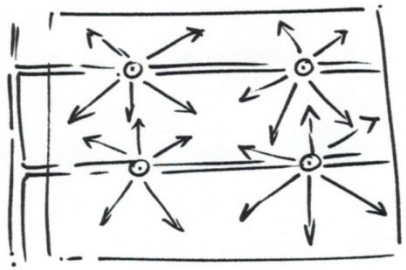
3



Systematic evaluation and improvement (30–45%)

Evaluate which locations are most susceptible to fire. Install heat sensors and sprinklers in those locations.

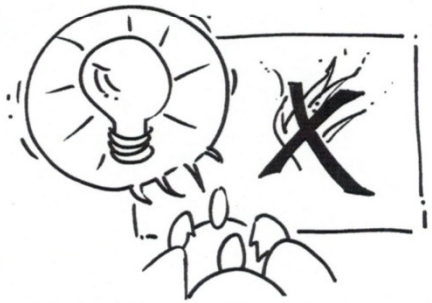
4



Learning and strategic improvement (50–65%)

Install systemwide heat sensors and a sprinkler system that is activated by the heat preceding fires.

5



Organizational analysis and innovation (70–100%)

Use fireproof and fire-retardant materials. Replace combustible liquids with water-based liquids. Prevention is the primary approach for protection, with sensors and sprinklers as the secondary line of protection.

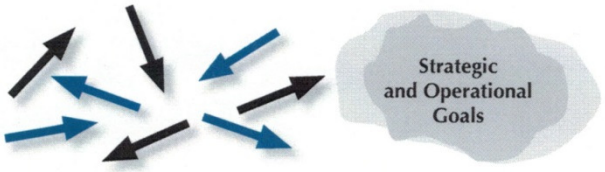
R. Kieffer

Malcolm Baldrige

Steps toward Mature Processes

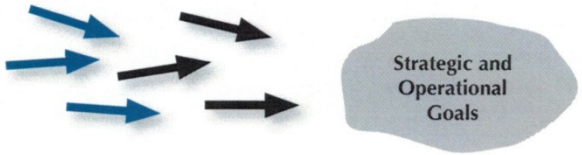
An Aid for Assessing and Scoring Process Items

Reacting to Problems (0–25%)



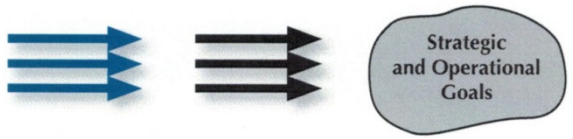
Operations are characterized by activities rather than by processes, and they are largely responsive to immediate needs or problems. Goals are poorly defined.

Early Systematic Approaches (30–45%)



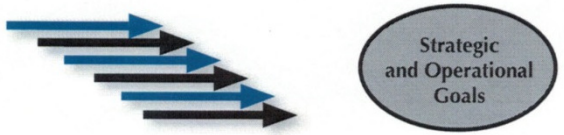
The organization is beginning to carry out operations with repeatable processes, evaluation, and improvement, and there is some early coordination among organizational units. Strategy and quantitative goals are being defined.

Aligned Approaches (50–65%)



Operations are characterized by repeatable processes that are regularly evaluated for improvement. Learnings are shared, and there is coordination among organizational units. Processes address key strategies and goals.

Integrated Approaches (70–100%)



Operations are characterized by repeatable processes that are regularly evaluated for change and improvement in collaboration with other affected units. The organization seeks and achieves efficiencies across units through analysis, innovation, and the sharing of information and knowledge. Processes and measures track progress on key strategic and operational goals.

R. Kieffer

MALCOLM BALDRIGE CORE VALUES AND CONCEPTS

- Visionary Leadership
- Customer-Driven Excellence
- Organizational and Personal Learning
- Valuing Workforce Members and Partners
- Agility
- Focus on the Future
- Managing for Innovation
- Management by Fact
- Societal Responsibility
- Focus on Results and Creating Value
- Systems Perspective

R. Kieffer

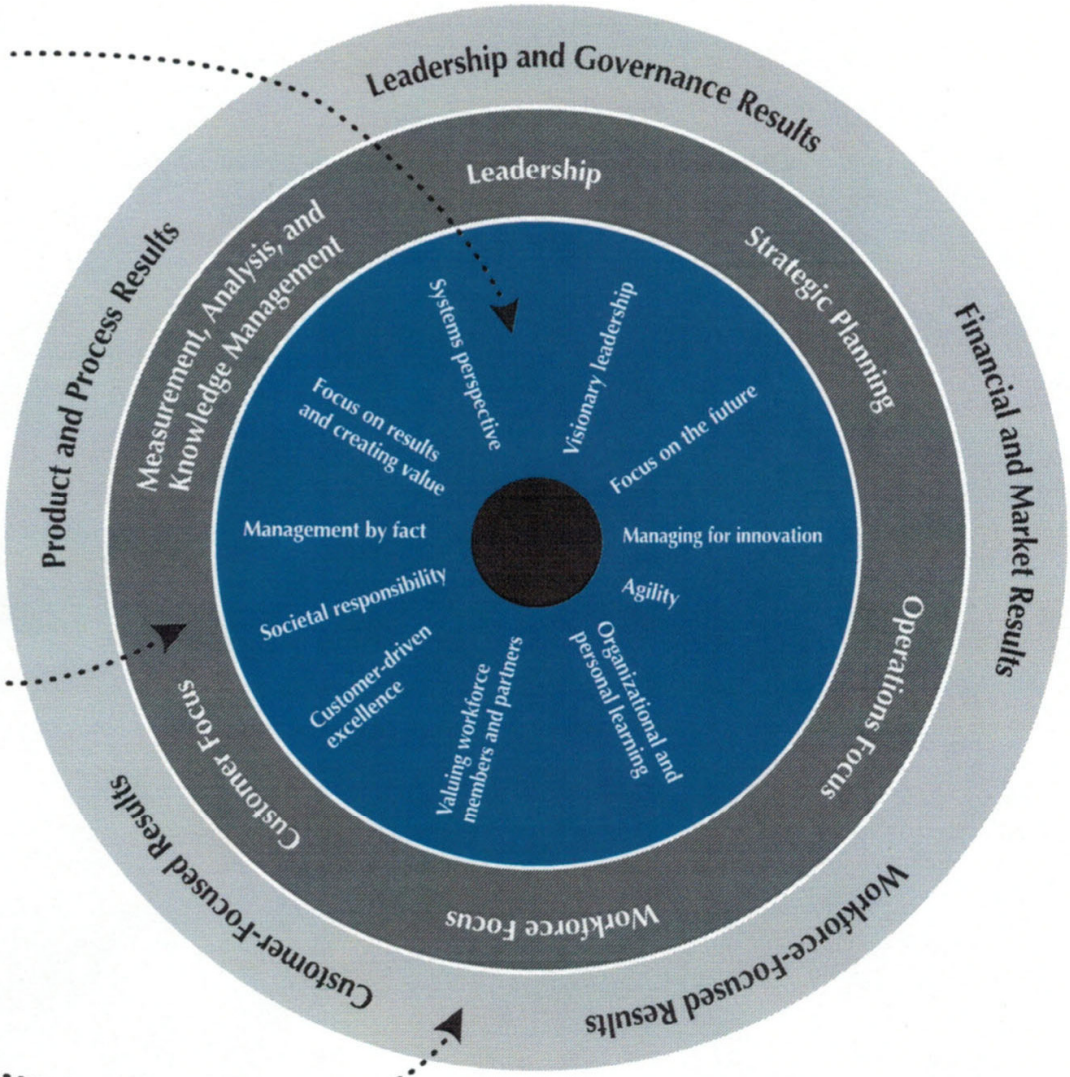
Malcolm Baldrige

The Role of Core Values and Concepts

The Baldrige Criteria build on **core values and concepts...**

which are embedded in **systematic processes...** (Criteria categories 1–6)

yielding **performance results.** (Criteria category 7)



R. Kieffer

WHAT DO THE MODELS HAVE IN COMMON?

St Gallens, Faisal Hogue, Shingo, Oliver Wight, Malcolm Baldrige

R. Kieffer

MATURITY SCALES

- **Oliver Wight**
- **Malcolm Baldrige Quality Award**
- **ISO-9004**
- **ISO/IEC 15504**
- **CEB Quality Leadership Council**
- **Kieffer et al., audit/assessment scale**

R. Kieffer

ISO-9004: 2009 - Self Assessment Tool

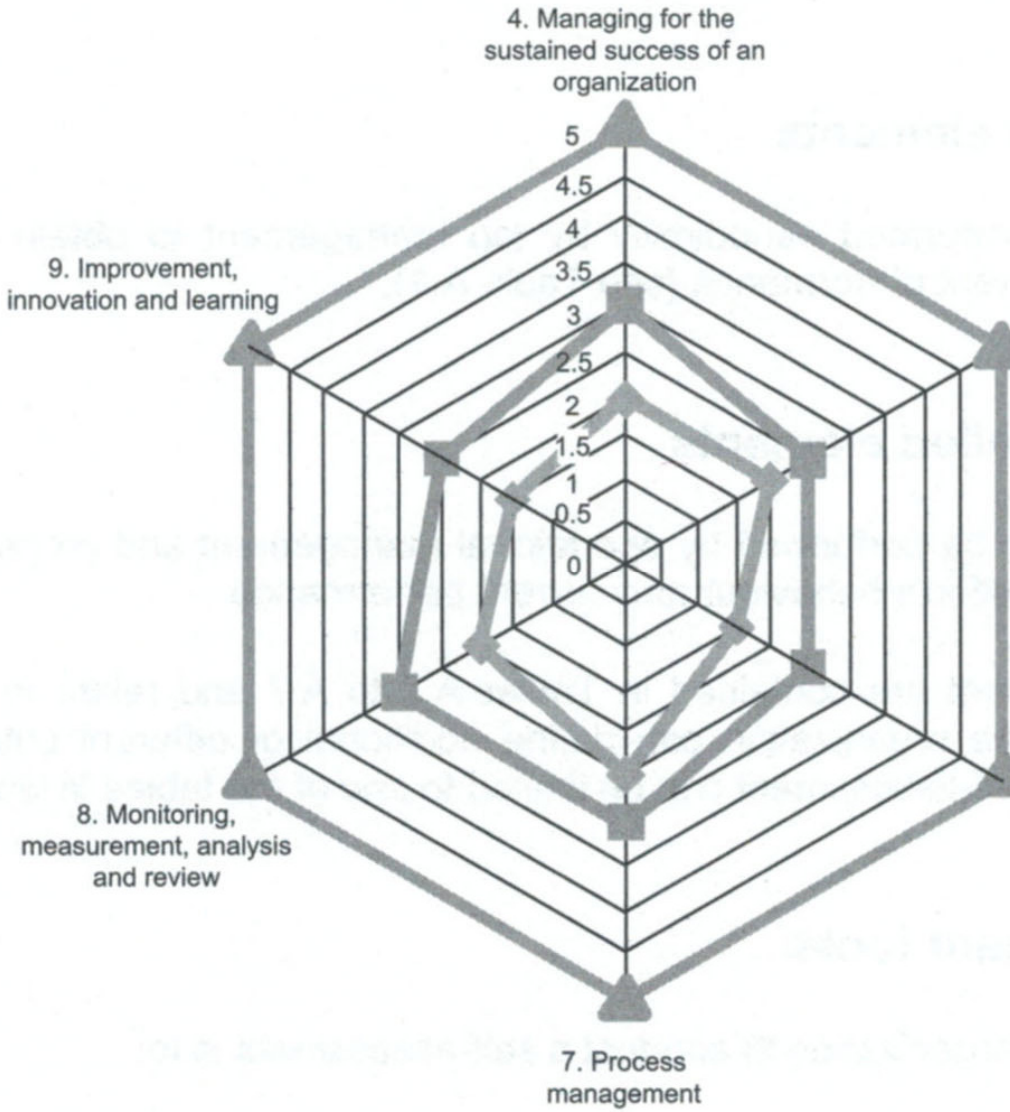
Maturity Model:

A mature organization performs effectively and efficiently and achieves sustained success by

- **understanding and satisfying the needs and expectations of interested parties**
- **monitoring changes in the organization's environment**
- **identifying possible areas for improvement and innovation**
- **defining and deploying strategies and policies**
- **setting and deploying relevant objectives**
- **managing its processes and resources**
- **demonstrating confidence in its people, leading to increased motivation, commitment and involvement**
- **establishing mutually beneficial supplier and other partner relationships.**

R. Kieffer

ISO 9004



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SELF ASSESSMENT

ISO 9004-2009

1. **Correlation between key elements and maturity levels**
2. **Managing for the sustained success of an organization**
3. **Strategy and Policy**
4. **Resource Management**
5. **Process Management**
6. **Monitoring, measurement, analysis and review**
7. **Improvement, innovation and learning**

R. Kieffer

ISO 9004

Table A.1 — Self-assessment of key elements — Correlation between key elements and maturity levels

Key element	Maturity level				
	Level 1	Level 2	Level 3	Level 4	Level 5
What is the management focus? **(Managing)**	The focus is on products, shareholders and some customers, with *ad hoc* reactions to changes, problems and opportunities.	The focus is on customers and statutory/regulatory requirements, with some structured reaction to problems and opportunities.	The focus is on people and some additional interested parties. Processes are defined and implemented for reacting to problems and opportunities.	The focus is on balancing the needs of identified interested parties. Continual improvement is emphasized as a part of the organization's focus.	The focus is on balancing the needs of emerging interested parties. Best in class performance is set as a primary objective.
What is the leadership approach? **(Managing)**	The approach is reactive, and is based on top-down instructions.	The approach is reactive, and is based on decisions by managers at different levels.	The approach is proactive, and the authority to take decisions is delegated.	The approach is proactive, with high involvement of the organization's people in its decision making.	The approach is proactive and learning-oriented, with the empowerment of people at all levels.
How is it decided what is important? **(Strategy & policy)**	Decisions are based on informal inputs from the market and other sources.	Decisions are based on customer needs and expectations.	Decisions are based on the strategy and linked to needs and expectations of interested parties.	Decisions are based on the deployment of the strategy into operational needs and processes.	Decisions are based on the need for flexibility, agility and sustained performance.
What is needed to get results? **(Resources)**	Resources are managed in an *ad hoc* manner.	Resources are managed effectively.	Resources are managed efficiently.	Resources are managed efficiently and in a way that takes into account their individual scarcity.	The management and use of resources is planned, efficiently deployed, and satisfies the interested parties.
How are the activities organized? **(Processes)**	There is a non-systematic approach to the organization of activities, with only some basic working procedures or instructions in place.	Activities are organized by function, with a basic quality management system in place.	Activities are organized in a process-based quality management system that is effective and efficient, and which enables flexibility.	There is a quality management system that is effective and efficient, with good interactions between its processes, and which supports agility and improvement. The processes address the needs of identified interested parties.	There is a quality management system that supports innovation and benchmarking, and which addresses the needs and expectations of emerging, as well as identified, interested parties.

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ISO 9004

Table A.1 (*continued*)

Key element	Maturity level				
	Level 1	Level 2	Level 3	Level 4	Level 5
How are results achieved? **(Monitoring & measurement)**	Results are achieved in a random manner. Corrective actions are *ad hoc*.	Some predicted results are achieved. Corrective and preventive actions are performed in a systematic way.	Predicted results are achieved, especially for identified interested parties. There is consistent use of monitoring, measurement and improvement.	There are consistent, positive, predicted results, with sustainable trends. Improvements and innovations are performed in a systematic way.	The achieved results are above the sector average for the organization, and are maintained in the long term. There is implementation of improvement and innovation throughout the organization.
How are results monitored? **(Monitoring & measurement)**	Financial, commercial and productivity indicators are in place.	Customer satisfaction, key realization processes and the performance of suppliers are monitored.	The satisfaction of the organization's people and its interested parties is monitored.	Key performance indicators are aligned with the organization's strategy and are used for monitoring.	Key performance indicators are integrated into the real-time monitoring of all processes, and performance is efficiently communicated to relevant interested parties.
How are improvement priorities decided? **(Improvement, innovation & learning)**	Improvement priorities are based on errors, complaints or financial criteria.	Improvement priorities are based on customer satisfaction data, or corrective and preventive actions.	Improvement priorities are based on the needs and expectations of some interested parties, as well as those of suppliers and the organization's people.	Improvement priorities are based on trends and inputs from other interested parties, as well as analysis of social, environmental and economic changes.	Improvement priorities are based on inputs from emerging interested parties.
How does learning occur? **(Improvement, innovation & learning)**	Learning occurs randomly, at an individual level.	There is systematic learning from the organization's successes and failures.	A systematic and shared learning process is implemented in the organization.	There is a culture of learning and sharing in the organization that is harnessed for continual improvement.	The organization's processes for learning are shared with relevant interested parties, and support creativity and innovation.

NOTE The current maturity level of the organization's individual elements is the highest level achieved up to that point with no preceding gaps in the criteria.

R. Kieffer

ISO 9004

Table A.2 — Self-assessment of the detailed elements of Clause 4 — Managing for the sustained success of an organization

Subclause	Maturity level				
	Level 1	Level 2	Level 3	Level 4	Level 5
4.1 (Managing for the sustained success of an organization) General	The quality management system is functionally oriented, based on procedures.	There is a process-based quality management system.	There is an organization-wide quality management system based on the eight quality management principles.	The organization's management system has been extended to integrate other disciplines, e.g. environmental management, health and safety management, etc.	The management system achieves full deployment of the organization's policy.
4.2 Sustained success	The organization's actual performance is compared with the budget in a regular yearly review.	There are periodic reviews of performance against the business plan.	The results show consistent improvement of performance over the past few years.	There has been sustained improvement in performance in the past, with evidence of planning for the short-term future (e.g. the next two years).	There has been sustained improvement in performance in the past, with evidence of planning for the long-term future (e.g. the next five years).
4.3 The organization's environment	The organization reacts to changes that impact on it.	Plans exist to mitigate any recurrence of past problems.	Risk assessments are made periodically to consider potential impacts on the organization.	Contingency plans exist to mitigate all identified risks to the organization.	Risk assessment and planning are continual processes within the organization, in order to mitigate all risks.
4.4 Interested parties, needs and expectations	The organization's overriding purpose is to make an annual profit.	The organization is driven by customer needs and expectations.	The needs and expectations of interested parties are satisfied where feasible.	The needs and expectations of interested parties are the main inputs for decisions by top management.	The needs and expectations of all relevant interested parties have been satisfied over the past few (e.g. three) years.
NOTE The current maturity level of the organization's individual elements is the highest level achieved up to that point with no preceding gaps in the criteria.					

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ISO 9004

Table A.3 — Self-assessment of the detailed elements of Clause 5 — Strategy and policy

Subclause	Maturity level				
	Level 1	Level 2	Level 3	Level 4	Level 5
5.1 (Strategy and policy) General **5.2 Strategy and policy formulation**	The planning process is organized in an *ad hoc* manner. Strategy, policies and objectives are only partly defined. Inputs into policy and strategy formulation are *ad hoc*, and only product and financially related aspects are formulated.	A structured process for the formulation of strategy and policies is in place. The process of strategy and policy formulation includes an analysis of the needs and expectations of customers, along with an analysis of statutory and regulatory requirements.	The process of strategy and policy formulation has evolved to include an analysis of the needs and expectations of a broader range of interested parties. Plans are developed after assessing the needs and expectations of relevant interested parties. The planning process includes consideration of changing external trends and the needs of interested parties; it makes necessary re-alignments when needed. Beneficial outcomes can be linked to past strategic approaches.	Strategy, policies and objectives are formulated in a structured manner. Strategy and policies cover aspects relating to relevant interested parties. The outcomes of the organization's processes for strategy and policy formulation are consistent with the needs of its interested parties. Threats, opportunities and availability of resources are evaluated and considered before plans are confirmed. Structured and periodic reviews of planning processes are in place.	It can be demonstrated that strategies have resulted in the achievement of the organization's objectives and optimization of the needs of interested parties. Interested parties are engaged in and contributing to the organization's success; there is confidence that the level of their contributions will be maintained. There is confidence that successes will be sustained. Effective monitoring and reporting mechanisms are in place, including feedback from interested parties for the planning process.
5.3 Strategy and policy deployment	Short-term objectives are used and deployed in daily operations. Strategic plans are defined for product realization.	Strategy and policies are translated into objectives for different levels in the organization. Plans are developed in accordance with the balance of the needs and expectations of customers. Strategy and policies are evolving; customer needs are deployed into clearly defined processes and objectives. They are the basis for performance reviews and audits.	Measurement of progress towards achievement of the organization's strategic objectives is undertaken. Positive and negative variances against plans are analysed and acted upon.	Measurable objectives are defined, for each process and level of the organization, and are consistent with the strategy. The management system is reviewed and updated, following changes in the strategy. Measurement of progress towards the achievement of objectives demonstrates that many positive trends exist.	Strategy, planning and policy deployment are regularly reviewed and updated using data from the monitoring and analysis of the organization's environment. Analysis of past performance can demonstrate that the organization has succeeded in overcoming emerging or unforeseen challenges.

R. Kieffer

ISO/IEC 15504 - A framework for the assessment of processes

For each process there is a defined capability level

5 Optimizing process

4 Predictable process

3 Established process

2 Managed process

1 Incomplete process

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ISO/IEC 15504

The capability of processes is measured using process attributes.

Process attributes:

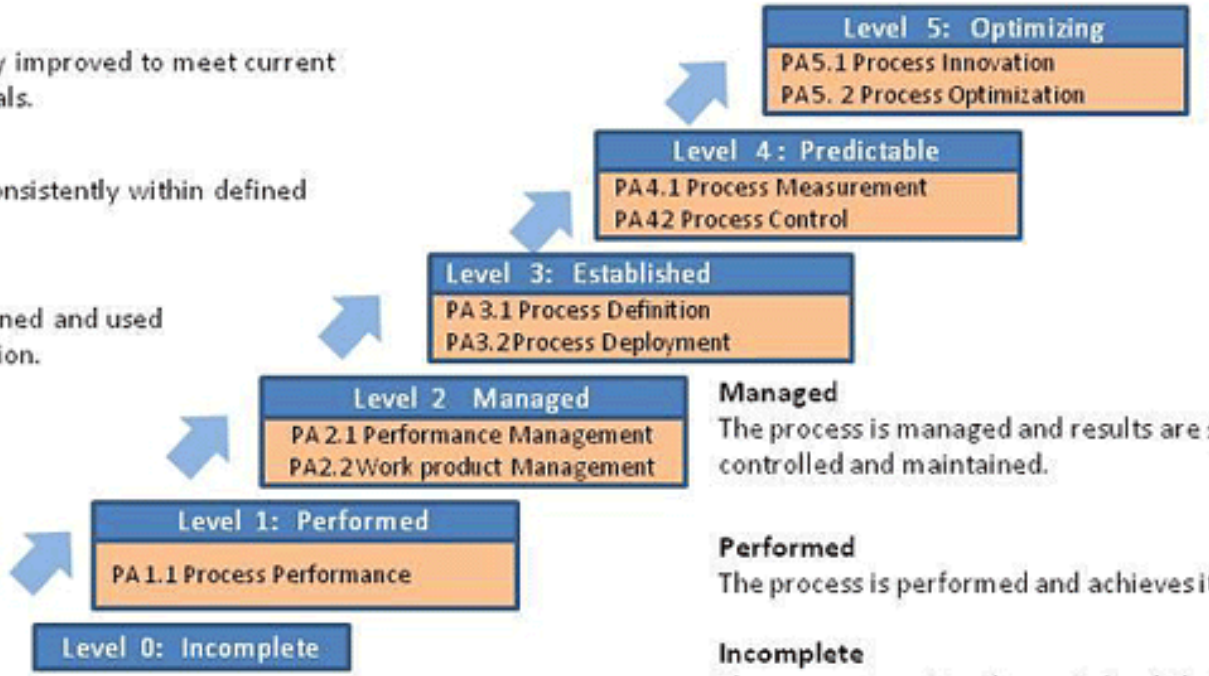
1. **Process performance**
2. **Performance management**
3. **Work product management**
4. **Process definition**
5. **Process deployment**
6. **Process measurement**
7. **Process control**
8. **Process innovation**
9. **Process optimization**

ISO/IEC Measurement Scale

Optimizing
The process is continuously improved to meet current and projected business goals.

Predictable
The process is executed consistently within defined limits.

Established
A standard process is defined and used throughout the organization.



Managed
The process is managed and results are specified, controlled and maintained.

Performed
The process is performed and achieves its purpose.

Incomplete
The process is not implemented or fails to achieve its purposes.

R. Kieffer

CEB Quality Leadership Council

Quality Functional Maturity Diagnostic

- 2 scales - maturity and importance

- Scope:
  - supplier quality
  - product quality
  - quality culture
  - customer quality
  - compliance management
  - operational excellence
  - cross-cutting processes
  - functional infrastructure

R. Kieffer

PROCESS AUDIT/ASSESSMENT

Nally, Kieffer, Stoker, "From Audit to Process Assessment - The More Effective Approach", Pharm. Tech. Sept. 1995

- **Focus on Process**
- **Used Malcolm Baldrige system of approach, deployment and results**
- **Rating scale 1 - 5**
- **Defined standards for each process, including hardware, for each rating**
- **Very dependent on competence of auditors/assessors**

R. Kieffer

Table IV: Ratings and process characteristics involved in labeling assurance and control.

1 High Risk	2 Moderate-risk	3 Meets standard (today)	4 Leading practices (pharmaceutical industry)	5 Best practices (all industries)
1. Labeling approval system ineffective (artwork/text/specifications).	1. Labeling-approval system partially effective (some ownership, integration, or deployment problems; inconsistent results or records).	1. Labeling-approval system effectively integrated within and between departments (marketing, legal, DRA,QA, purchasing).	1. Labeling-approval system well integrated and improving. Cycle time for approvals decreasing. Computerized systems in place for text and label generation or control.	1. Labeling-approval system fully automated, on-line, and rapid. Label text verification systems in full use. Cycle times improving from days to hours.
2. Capability or reliability of labeling suppliers unknown.	2. Some labeling suppliers being visited or audited. Some controls adequate.	2. Labeling suppliers being audited, corrective actions ongoing, control adequate.	2. Some labeling suppliers being certified and integrated into the labeling approval process.	2. Labeling suppliers fully integrated and partners in the labeling process.
3. Labeling materials management ineffective (receipt, inspection, release, storage, issuance, coding, returns, reconciliation). High potential for label mix-up or error (look-alike labeling, cut labeling, no scanning equipment, off-line coding).	3. Labeling materials management partially effective (some ownership, integration, or deployment problems; inconsistent results or records). Some potential for label mix-up or error.	3. Labeling materials management effectively integrated (materials, QA, manufacturing) and consistently deployed. Almost no potential for label mix-up or error. Look-alikes minimized, some scanners in use, 100% inspection of cut labeling occurring.	3. Labeling materials management automated, well integrated, and improving. Cycle times and inventory levels improving. Some text verification systems in place. No potential for label mix-up or errors. Automatic scanners in use for all cut labeling and some roll labeling.	3. Labeling materials management fully automated and on-line. Labeling inventory levels extremely low. Text verification systems in full use. No potential for label mix-up or errors. Automatic scanners used on all labeling.
4. Numerous labeling errors.	4. Labeling errors occurring. Systems not fail-safe.	4. Labeling text accurate and supportable. Systems approaching fail-safe.	4. Labeling text more user-friendly. Systems virtually fail-safe.	4. Labeling text user-friendly and based on consumer needs. Systems fail-safe.

R. Kieffer

ASSESSMENT RATING

5. Excellent/best-in-class practices

4. Superior/industry-leading practices

3. Meets standards consistently

2. Below standard/moderate risk

1. Below standard/high risk

R. Kieffer

A.2 Performance maturity levels

The performance maturity levels used in this self-assessment approach are shown in Table A.1.

Table A.1 — Performance maturity levels

Maturity level	Performance level	Guidance
1	No formal approach	No systematic approach evident, no results, poor results or unpredictable results.
2	Reactive approach	Problem- or corrective-based systematic approach; minimum data on improvement results available.
3	Stable formal system approach	Systematic process-based approach, early stage of systematic improvements; data available on conformance to objectives and existence of improvement trends.
4	Continual improvement emphasized	Improvement process in use; good results and sustained improvement trends.
5	Best-in-class performance	Strongly integrated improvement process; best-in-class benchmarked results demonstrated.

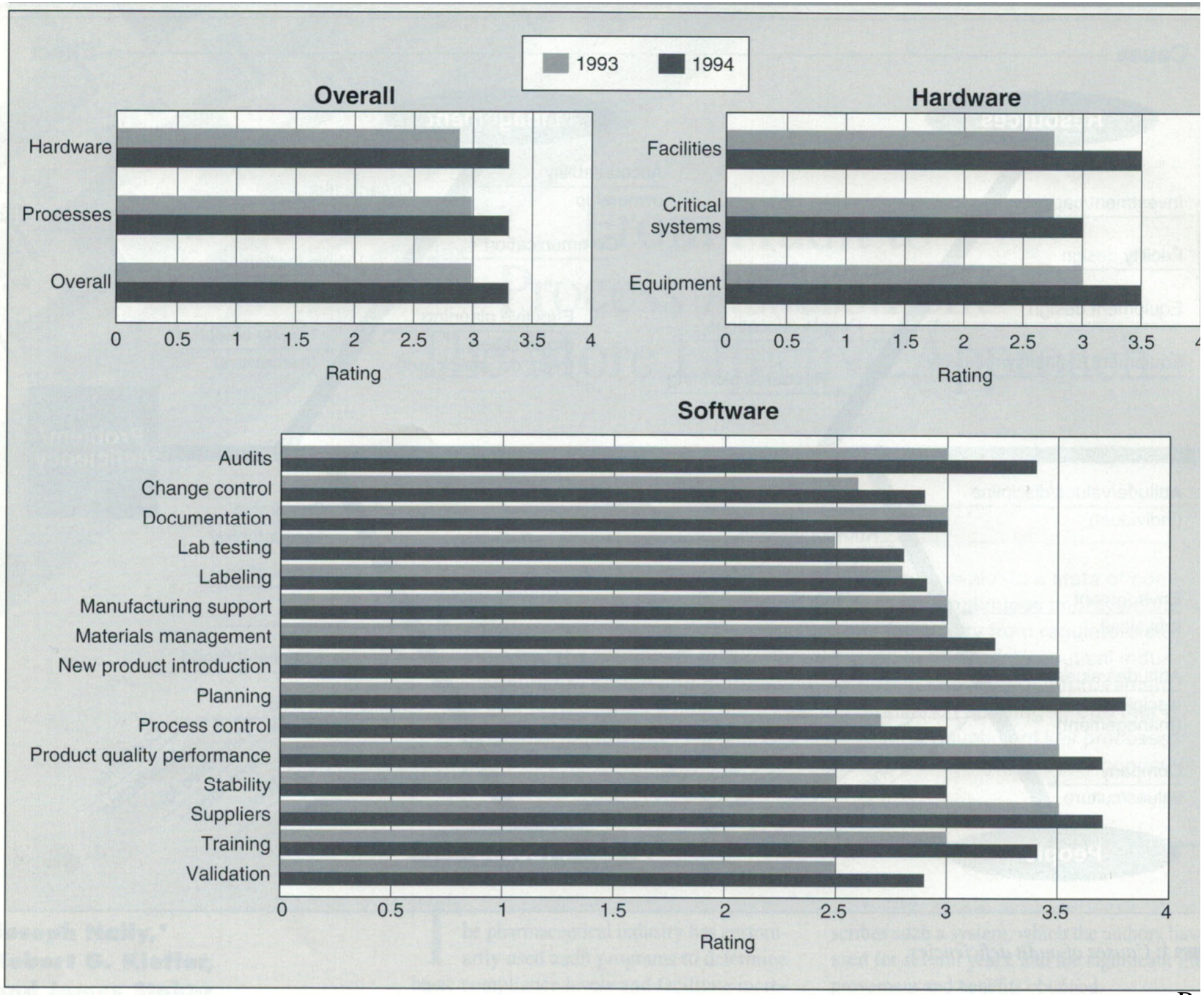
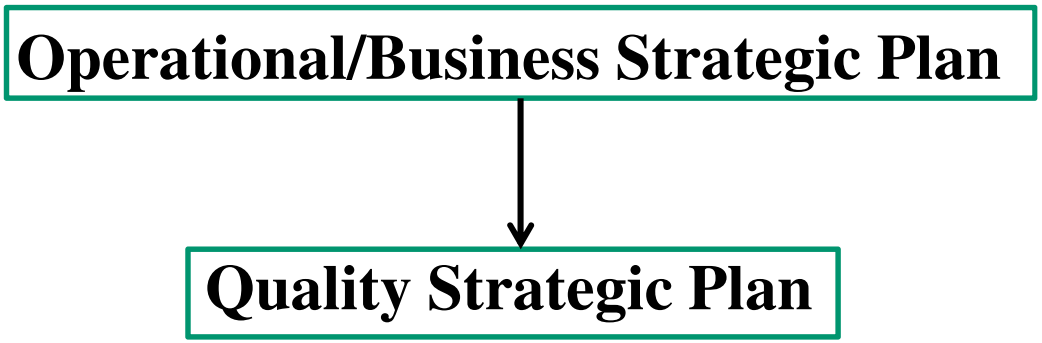


Figure 3: *Assessment results. Simple bar chart comparisons can be used to show year-to-year improvement.*

R. Kieffer

HOW TO START



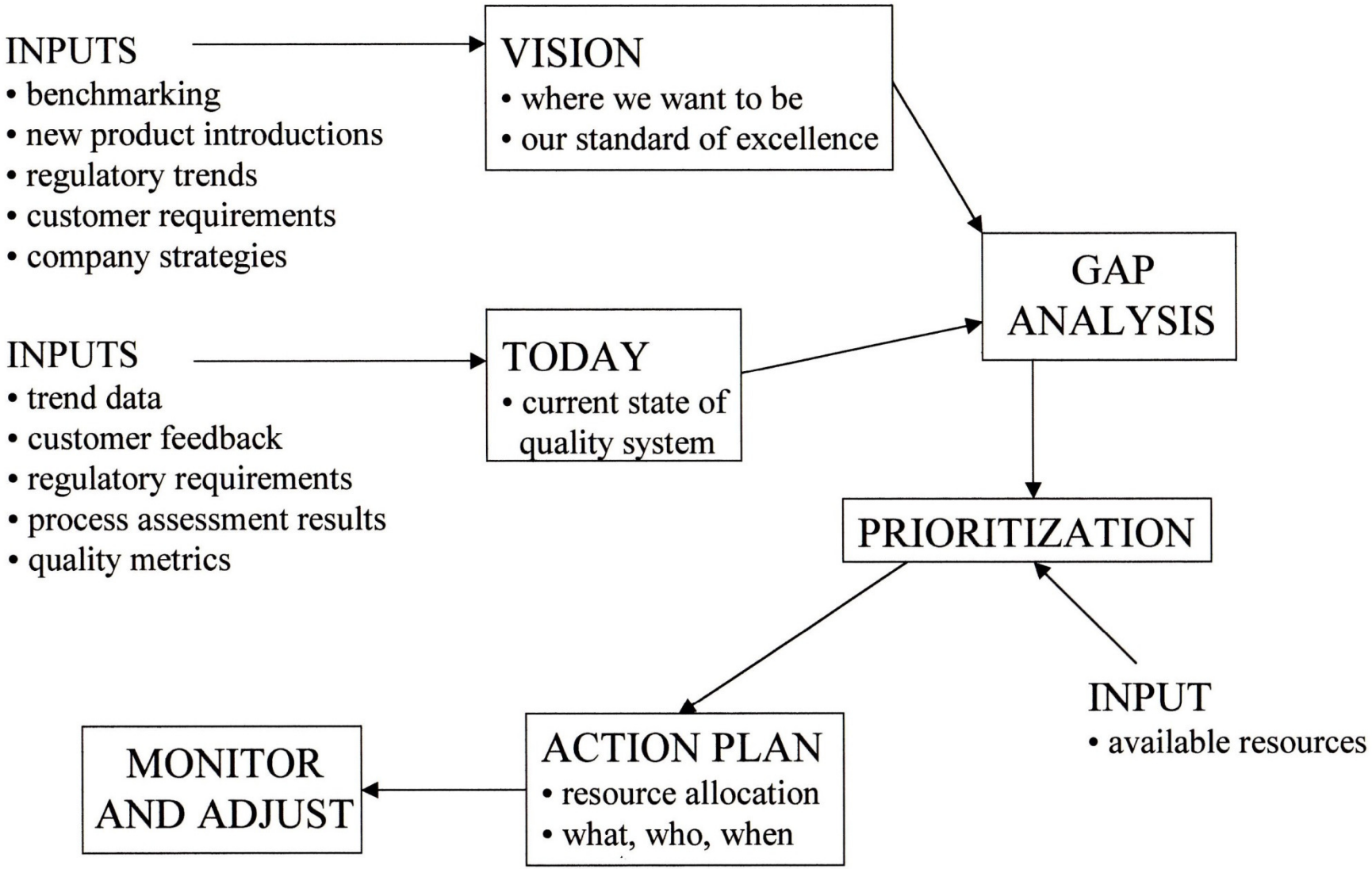
Vision/Mission/Strategic Goals

Comprehensive analysis/audit of current operation

It will take 5 - 10 years of consistent hard work to achieve operational excellence, world class.

R. Kieffer

Figure 4. THE PLANNING PROCESS



CHANGE

Overcoming Inertia

Benefits/Barriers Analysis

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CHANGE

- **PERSONAL**
- **ORGANIZATIONAL**

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KNOWLEDGE

There is much to know,
and so little time to learn;
one does not live who does not know.
A man without knowledge is a
universe in darkness.

Baltasar Gracian (1601-1658)

R. Kieffer

CHANGE

“What! Have I reached the age of 80 merely to think the same things all the time? On the contrary, I do my utmost to think something different, something new, every day, so that I don’t become boring. If one is not to stagnate, one must be constantly changing, regenerating oneself, growing young again.” (Goethe)

R. Kieffer

LEADING CHANGE: Why Transformation Efforts Fail

John P Kotter, HBR 78:60-67

EIGHT STEPS TO TRANSFORMING YOUR ORGANIZATION

1. **Establishing a Sense of Urgency**
   - Examining market and competitive realities
   - Identifying and discussing crisis, potential crisis, or major opportunities

2. **Forming a Powerful Guiding Coalition**
   - Assembling a group with enough power to lead the change effort
   - Encouraging the group to work together as a team

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3. Creating a Vision

- Creating a vision to help direct the change effort
- Developing strategies for achieving that vision

4. Communicating the Vision

- Using every vehicle possible to communicate the new vision and strategies
- Teaching new behaviors by example of the guiding coalition

5. Empowering Others to Act on the Vision

- Getting rid of obstacles to change
- Changing systems or structures that seriously undermine the vision
- Encouraging risk taking and nontraditional ideas, activities and actions

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6. Planning for and Creating Short-Term Wins

- Planning for visible performance improvements
- Creating those improvements
- Recognizing and rewarding employees involved in the improvements

7. Consolidating Improvements and Producing Still More Change

- Using increased credibility to change systems, structures, and policies that don't fit the vision
- Hiring, promoting, and developing employees who can implement the vision
- Reinvigorating the process with new projects, themes, and change agents

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8. Institutionalizing New Approaches

- Articulating the connections between new behaviors and corporate success
- Developing the means to ensure leadership development and succession

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Change is resisted and takes too long.
Causes

Employees not participating in the planning.

Lack of communication on direction.

Accountability lacking.

Objectives not cascaded throughout the organization.

No rewards for risk taking.

Weak emphasis on teamwork.

Fear of failure and exposure.

(Gwen Bush, Quality Progress, Oct. 2014)

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ROLE OF EXTERNAL CHANGE AGENT

**“A system can not understand itself.
The transformation requires a view
from outside.” (Deming)**

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CONCLUSIONS

"Halting the rot where resources are expended unnecessarily on activities that maintain the status quo - or worse, on activities that are tied up in fighting fires associated with poor quality or performance - will require enlightened management determined to achieve excellence across all aspects of the operation."

The ICH Q10 "emphasis on improvement and enhancing process robustness runs contrary to the traditional inertia for change that all too often still prevails within the pharmaceutical industry."
(Calnan)

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CONCLUSIONS

- **Implementing ICH Q10 should provide measureable business benefits.**
- **ICH Q10 is a good starting point in the journey to Operational Excellence.**
- **Implementing ICH Q10 requires a paradigm shift in our thinking.**
- **Need to focus more on cost of quality; include in management review.**

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Conclusions

An integrated quality management system implementation should not be taken lightly. It must be a careful, planned design that should be carried out in order to maximize benefits and minimize unwanted outputs. Several requirements should be considered before, during and after an integration process:

- **top management commitment,**
- **resources availability,**
- **communication,**
- **integrated training across the organization,**
- **integrated audits,**
- **technical guidelines,**
- **customer, employees and certification entities support.**

(Paulo Sampio, Univ. of Minho, Portugal)

CRITICAL REQUIREMENTS FOR SUCCESS

- **Integration:** quality management is a component of manufacturing management which is a component of business management
- **Manufacturing** must take a leading role
- **Involvement of top management** (It requires their *time*.)
- **Long term view**
- **Know-how**
- **Don't wait for the FDA**
- **Change**

R. Kieffer

References:

1. **Calnan, et al., "Enabling ICH Q10 Implementation - Part 1. Striving for Excellence by Embracing ICH Q8 and ICH Q9."**
2. **Calnan, "The 80/20 Rule of Knowledge", Supplement to Pharm. Eng., May 2014**

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Appendices

1. **PAT**
2. **Lean Manufacturing**
3. **Six Sigma**
4. **Overall Equipment Effectiveness (OEE)**

Appendix 1. PAT

PAT processes are designed to measure in real time the attributes of an in-process material and then adjust the process in a timely control loop.

Benefits:

- **Reduced cycle time**
- **Reduced waste**
- **Real time release**

Requires extensive process understanding.

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Appendix 2. Lean Manufacture

A production philosophy that considers the expenditure of resources in any aspect other than the direct creation of value for the end customer wasteful.

1. **Overproduction**
2. **Waiting**
3. **Inventory**
4. **Transportation - efficient movement of materials**
5. **Over-processing - work on product too many times**
6. **Motion - efficient movement of people and equipment**
7. **Defects**
8. **Workforce - Do you use workers efficiently?**

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Appendix 3. Six Sigma

Set of practices designed to improve manufacturing processes and eliminate defects.

Sigma	Cost of Quality
2σ	25-35%
3σ	20-25%
4σ	12-18%
5σ	4-8%
6σ	1-3%

(K. van Nes)

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A six sigma process is one that produces 3.4 defective parts per million opportunities (DPMO).

An efficiency of 99.9997%

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SIX SIGMA

DMAIC

Define a problem

Measure process performance

Analyze to determine root causes of poor performance

Improve the process by attacking root causes

Control the improved process

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Appendix 4. Overall Equipment Effectiveness (OEE)

A way to monitor and improve the effectiveness of your manufacturing processes.

Three factors - availability, performance and quality

Availability = operating time/planned production time
Planned production time = operating time + down time
Down time = equipment failures + material shortages + changeover time

Performance takes into account speed loss, which includes any factors that cause the process to operate at less than the maximum possible speed when running. Examples: machine wear, substandard materials, operator inefficiency.
Performance = ideal cycle time/actual cycle time
Actual cycle time = net operating time + speed loss

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OOE

Quality = good pieces/total pieces

OOE = Availability x Performance x Quality

Semi conductor industry, OOE >85%
Pharmaceutical Industry, OOE<50%
Food and Beverage Industry average, OOE = 44%
Pharmaceutical Industry average, OOE = 29%
(K. van Nes)

R. Kieffer