# Summary of Manager of Quality/Organizational Excellence Body of Knowledge

Robert B. Austenfeld, Jr.
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## Introduction

The purpose of this paper is to summarize the body of knowledge (BOK) the American Society for Quality (ASQ) uses to develop its examinations for Manager of Quality/Organizational Excellence (MOQ/OE) certification. Although Austenfeld (2007/2008) did this in two parts it is thought that a condensed version in one article would be much more useful as a handy reference—thus this paper. This information should be helpful for anyone involved with ensuring the quality of its company's products and service or simply as a guide to good management practices. It will also serve as a helpful reference for anyone preparing to take the MOQ/OE certification exam.

Westcott (editor) (2006) is the basic reference for this BOK and the basis for this paper. All page citations refer to Westcott (2006). This book is also the basic reference for ASQ's three-day refresher training course for the certification exam. It is cautioned that although this paper contains a lot of information, it is highly condensed and should best be used in conjunction with Westcott. Also anyone planning to take the certification exam will definitely want to study the Westcott
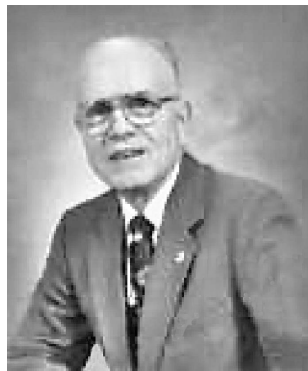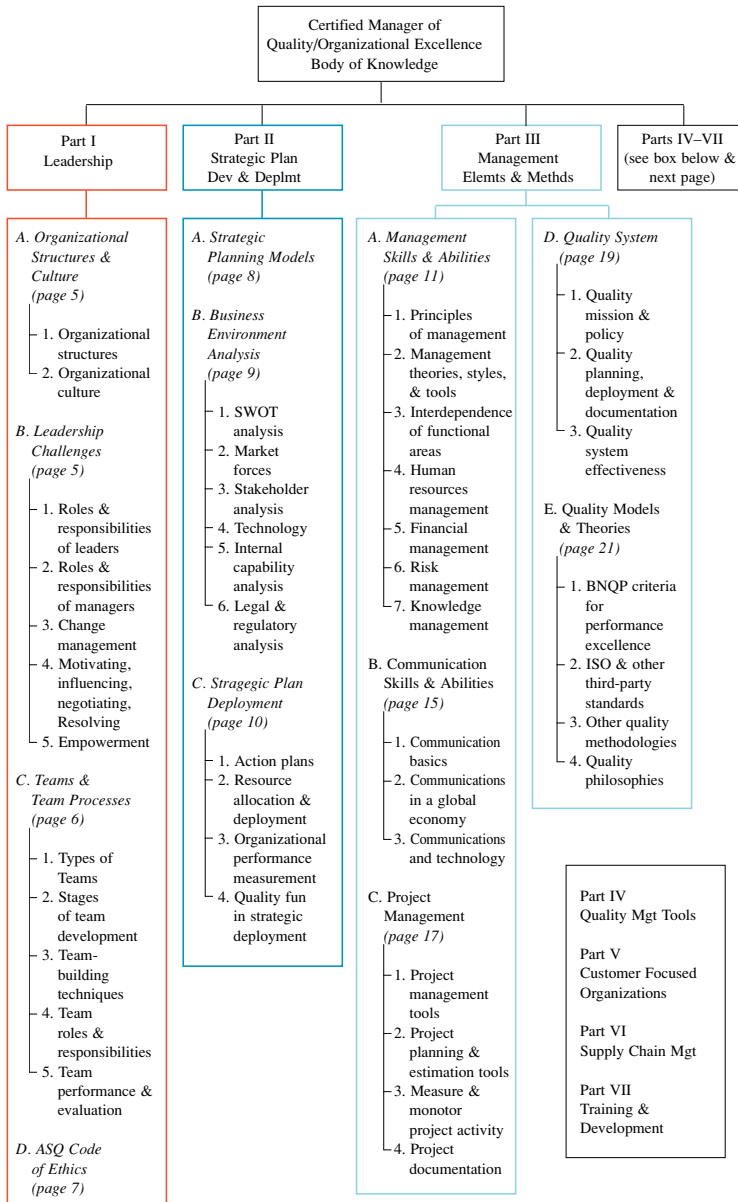
Russ Westcott, ASQ
Fellow, Certified Manager
of Quality, Quality Auditor

book and probably some of the many references to other material contained therein.

The Austenfeld (2007/2008) summary included two parts for each of Westcott's seven chapters: a summary of the essential points of that chapter and a listing of certain other key points felt particularly noteworthy. In the interests of brevity the "other key points" have been omitted from this paper and may be the subject of a future paper that could serve as a companion to this one.

To help the reader better see the BOK as a whole and where each part fits into that whole the next two pages are an outline of the book and this paper. This outline also serves as a table of contents to facilitate quickly finding an area of interest.

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# I. Leadership

**A.  *Organizational Structures and Culture*** (I. Leadership)
1. *Organizational structures:*
   a. Three things determine the design of an organization: complexity, formal-ization, and centralization.
   b. Purposes of organizational design include logically dividing up the work and setting up formal lines of authority and responsibility.
   c. Important considerations when designing an organization include maintain-ing unity of command and a reasonable span of control.
   d. Another important consideration is the extent to which decision-making authority will be centralized/decentralized.
   e. There are many possible ways to group an organization's work functions: functionally, geographically, by matrix, etc.
   f. When developing the organization's structure several other things should be taken into consideration; e.g., the organization's strategy, its size, the role of technology, etc.
   g. In most organizations there are three levels of management—top, middle, and first-level supervision, each with its distinctive role.
2. *Organizational culture:*
   a. An organization is the combination of two main systems: technical and social. The technical system determines how the product/service is pro-duced/delivered and the social (cultural) how people interrelate and make decisions.
   b. An organization's culture is based on the "values, norms, and assumptions shared by the members" (p. 14).
   c. An organization's culture should be proactively shaped by management and focused on the customer.
   d. Changing an existing culture will take time, patience, and persistence.

**B.  *Leadership Challenges*** (I. Leadership)
1. *Roles and responsibilities of leaders:*
   a. A leader is recognized as such, has followers, and may or may not hold a designated position (as a manager does).
   b. A good leader is, among other things, a visionary, creative, patient, sensi-tive to employee and customer issues, and highly self-disciplined.
   c. A good leader uses a style appropriate to each situation (situational leader-ship).
2. *Roles and responsibilities of managers:*
   a. Managers are in charge of the work of the organization and use its resources to accomplish its strategic and operational objectives.
   b. Managers carry out five functions: planning, organizing, staffing, directing, and controlling.

   c. Good managers are competent in the following areas: technical, business, people (e.g., human behavior), human resource (e.g., hiring and training), and environmental (e.g., competition and earth sciences).

3. *Change management:*
   a. Change management means being sure those affected understand the need for the change and come to accept it as a positive thing.
   b. A change agent can be either someone appointed from within the organization (internal change agent) or someone hired from outside the organization (external change agent).

4. *Motivating, influencing, negotiating, resolving:*
   a. There are two types of motivation: extrinsic (due to specific incentives by the organization) and intrinsic (due to satisfaction inherent in the job itself).
   b. Some important theories of motivation are: Maslow's Hierarchy of Needs, Herzberg's Satisfiers/Dissatisfiers, Equity Theory, Expectancy Theory (Vroom), and Reinforcement Theory (Skinner).
   c. What motivates one person may not motivate another.
   d. Negotiation is trying to reach an agreement on common goals and how those goals will be achieved.
   e. Conflict resolution can range from simply working for a consensus with cooperating parties to intervention by a trained facilitator.

5. *Empowerment:*
   a. Empowerment is based on a belief that employees are capable of taking on more responsibility and authority (with appropriate support such as training).
   b. Empowerment requires an organizational structure that places management in a support vs. purely directive role vis-à-vis the employee.

**C. *Teams and Team Processes*** (I. Leadership)

> A team is a group of persons working together towards a common purpose; it could be temporary or ongoing.

1. *Types of teams:*
   a. Types of teams include process improvement teams, self-managed teams, ad hoc teams (to address a specific problem/situation), work groups (also known as natural teams), and virtual (on line) teams.
   b. When selecting team members a useful tool is the KESAA* Requisites Analysis. Two other useful tools are the Myers-Briggs Personality Type Indicator and the DiSC** model.
     *KESAA stands for Knowledge, Experience, Skills, Aptitude, and Attitude. See Appendix A for an example of a KESAA Requisites Analysis.
     **As defined in the glossary of Westcott, DiSC is: A profiling instrument that measures characteristic ways in which a person behaves in a particular environment. Four dimensions are measured: dominance, influence, steadiness, and conscientiousness.

2. *Stages of team development:*

   The four stages of team development are: forming, storming, norming, and performing (Tuckman). (See Westcott pp. 68–70.)

3. *Team building techniques:*

   a. Team processes fall into two categories: those that help keep the team focused on its goal (task-related) and those that help maintain a harmonious relationship among the members (maintenance-related).

   b. Some task-related processes are: documenting/reviewing the team's objective, always following the agenda, and using models and techniques appropriate to the task for problem-solving and decision-making.

   c. Some maintenance-related processes are: establishing norms (e.g., being on time and active participation by every member) and assigning members roles (e.g., scribe to take minutes of the meeting and a timekeeper).

4. *Team roles and responsibilities:*

   a. Other important team-related roles are those of the champion/sponsor of the project, the team leader and, when needed, the team facilitator.

   b. If the team's project is important enough, a steering committee representing top management might be formed to monitor and guide its effort.

   c. Usually it is important to have a written charter to define the team's scope of work, authority and responsibility, expected deliverables, and reporting requirements.

   d. Whereas the team leader is concerned primarily with team administration and ensuring accomplishment of its objective, the team facilitator is concerned with helping the team to work effectively together as a cohesive unit.

   e. Some things the facilitator does to help the team are: encourage everyone to participate, resolve conflicts, and provide feedback on how the team is doing.

5. *Team performance and evaluation:*

   a. Evaluation of team performance should take place at both the team and organizational levels. For example, at the team level criteria can be developed and used at the end of each meeting to evaluate how the team did. At the organizational level such things as meeting the schedule and measurable improvements in quality can be used.

   b. Successful team accomplishment should be appropriately rewarded.

   c. A common problem with teams is groupthink—when the team agrees on something without it having been fully discussed and/or one or more members don't really agree (but don't say so).

**D. *ASQ Code of Ethics*** (I. Leadership)

*ASQ Code of Ethics* (see Appendix B)*:*

   a. An important duty of the organization's leadership is to clearly define and set forth to all members what is acceptable behavior.

b. The leaders must also demonstrate what is acceptable by their own behavior.

c. Employees who abide by the principles of good behavior—especially under difficult conditions—are to be praised; those that don't follow these principles are to be dealt with appropriately.

## II. Strategic Plan Development and Deployment

A. *Strategic Planning Models* (II. Strategic Plan Development and Deployment)
*Strategic planning models:*

a. Traditional strategic planning (1) identifies those goals the organization wishes to achieve to fulfill its stated mission and vision of the future and (2) establishes tactical objectives and associated action plans that will lead to achievement of those goals.

b. A strategic plan typically covers a three to five year span.

c. Ideally there is a systematic follow up to ensure the action plans are carried out so the tactical objectives and strategic goals actually get achieved.

d. However, too often the strategic plan goes unfulfilled due to a lack of commitment for its deployment/execution on the part of top management.

e. Hoshin planning is a comprehensive approach to strategic planning that ensures the resulting plan will be properly and timely executed.

f. Hoshin planning starts with development of the vision statement and then development of each of the following based on what preceded: guiding principles, a mission statement, strategic goals, multiyear objectives, a means matrix for each objective, and action plans for each means.

g. The means matrix is the way the strategy gets deployed throughout the organization by identifying who will be responsible for what vis-à-vis each strategic objective. It also identifies the measures to be used and schedules to be followed.

h. The final part of hoshin planning is to review how it going at the end of each year and use this information to update the strategy and associated objectives, means, and action plans.

i. Scenario planning is a way for an organization to challenge its assumptions about the future by thinking about all possible futures including "bad," "good," and "wild card."

j. The set of criteria of the Malcolm Baldrige National Quality Program (MBNQP) provide an excellent tool for evaluating an organization's strategic planning process.

k. Two popular programs that can significantly contribute to the improvement of an organization's quality and thus attainment of its strategic goals are the ISO 9001 standard and Six Sigma.

l. Some reasons why strategic planning fails: ambiguous terms (e.g., the meaning of "goal" vs. "objective"), no supporting reward/recognition system,

departmental plans not based on the overall strategy, and management not
consistently backing the strategic planning and implementation effort.

**B. *Business Environment Analysis*** (II. Strategic Plan Development and Deploy-
ment)

> 1. A business environment analysis provides a key input to the strategic
> planning process.
> 2. A business environment analysis looks at how external and internal fac-
> tors might impact the organization; for example, external factors such as
> societal and technology changes and internal factors such as an
> organization's customer base and internal capabilities.

1. *SWOT analysis:*
   A SWOT analysis identifies the organization's strengths and weaknesses and
   the opportunities and threats presented by the current and future marketplace.
2. *Market forces:*
   a. A general examination of the market forces is another source of input for
      strategic planning. Here such things as economic, societal, and competitive
      factors affecting the organization's industry and specific markets are
      assessed.
   b. When looking at the competitive forces that might affect an organization's
      strategy, some good questions are: who are the competitors, are they form-
      ing alliances, how aggressive are they (constantly coming out with new
      products/services?), how are they using technology, and what are their
      weaknesses?
   c. Benchmarking studies the best practices of a company known for superior
      performance so those practices can be adapted by the organization. Such a
      study often reveals ways to significantly improve an organization's com-
      petitive advantage.
3. *Stakeholder analysis:*
   A stakeholder analysis systematically looks at how actions and/or interests of
   the organization's various stakeholders might impact its strategy; for
   example changes in the strategies of its customers and/or suppliers and vice
   versa, and the responsibilities an organization has to its community and
   society as a whole.
4. *Technology:*
   Another major consideration when planning strategy is whether an organiza-
   tion should adopt a new technology.
5. *Internal capability analysis:*
   a. An internal capability analysis seeks to fully understand and exploit those
      key (core) competencies that enable an organization to successfully com-
      pete.
   b. In doing an internal capability analysis an organization looks at such things

as current and future availability of labor, facilities, funds, supplies, and leadership/management skills. Input from customers and employees can also provide a significant contribution to the analysis.

6. *Legal and regulatory analysis:*

A legal and regulatory analysis will also provide a valuable and necessary input to the strategic planning process. Indeed in today's world there are a multitude of legal and regulatory matters an organization must contend with and they are often changing!

C. **Strategic Plan Deployment** (II. Strategic Plan Development and Deployment)

> Strategic plan deployment means transforming the strategic plan into tactical action plans and then carrying out those action plans as close to cost/ schedule as possible. This is often called "the hard part" of the strategic planning process and requires "discipline and solid top management support" (p. 125).

1. *Action plans:*
   a. As mentioned under hoshin planning above, the action plans are based on the means matrices and, relative to each strategic objective, collectively provide all the details necessary for its achievement. There may be several action plans for each strategic objective.
   b. Typically an action plan will include the following information: when each action starts/ends, who is responsible for each action, estimated costs/benefits, assumptions, deliverables, measures of success, and reporting requirements.

2. *Resource allocation and deployment:*
   a. Before an action plan can be finalized, it is necessary to ensure required resources will be available. This requires the development of a means matrix as already mentioned.
   b. The means matrix ensures that all parts of the organization affected by any of the action plans are involved in planning the actions necessary and ultimately agree to provide whatever resources are required of them.

3. *Organizational performance measurement:*
   a. A key element of the strategic planning process is the effective use of measures. These can range from measures at the individual process level, to those related to action plan progress and success, to overall organizational performance.
   b. Measures should always be "closed-loop," i.e., have a built-in feedback loop for using the measurement data to take appropriate corrective action.
   c. At the action plan level, one important measure is regular reviews of progress by management.
   d. At the organizational level the balanced scorecard is a popular method for measuring performance. The balanced scorecard goes beyond purely financial measures of performance, it also measures how well the organization

is doing in the areas of customer satisfaction, improving its internal business processes, and learning and growing.

e. When setting up measures it is important to focus on exactly *what* needs to be measured and how often.

4. *Quality function in strategic deployment:*

The quality function (manager) plays a major role in the strategic planning process that includes development of the quality policy, quality management principles, and strategic quality objectives. It also includes auditing quality practices and working to improve the strategic planning process itself.

# III. Management Elements and Methods

A. *Management Skills and Abilities* (III. Management Elements and Methods)

1. *Principles of management:*

a. Management's role is "to plan, carry out, monitor, and initiate action to maintain the appropriate focus and results, and to ensure viability of the organization in the future" (p. 144).

b. As mentioned in section I.A.1, there are three levels of management: top management, middle management, and first-level supervision.

c. Generally speaking, top managers set the overall direction for the organization, middle managers transform that strategic direction into operational plans, policies, and procedures, and first-level supervisors manage the work of a particular part of the organization according to those plans, policies, and procedures.

d. As mentioned in section I.B.2 there are five things managers do: planning, organizing, staffing, directing, and controlling. The scope of these functions depends on the level of management and ranges from a broad, strategic one at the top level to a relatively narrow one at the supervisor level.

2. *Management theories, styles, and tools:*

a. There are a number of theories related to management:

| Theory (ies) | Some Associated Names |
|---|---|
| Scientific Management | Taylor, the Gilbreths, Gantt |
| Classical Organizational Theory | Fayol, Weber, Follett |
| Human Relations Theory | Hawthorne Plant of Western Electric |
| Behavior Theories | Maslow, Herzberg, McGregor, Ouchi |
| Learning Theories | Kolb, Honey & Mumford, Gardner |
| Behavior Management | Skinner, Daniels |
| Situational Leadership/Management | Hersey & Blanchard |
| Systems Thinking | Senge (*The Fifth Discipline*) |

| Complexity Theory | Okes |
|---|---|
| Managerial Grid | Blake & Mouton |
| Seven Habits | Covey |

b. Some tools managers can use to help them understand human behavior are: DiSC (see above I.C.1.b), the Myers-Briggs Personality Type Indicator, and A-B-C Analysis*,

  *A-B-C Analysis uses a form to collect data on an individual or work group that can be analyzed to detect possible dysfunctional behavior.

c. As with management theories, there are a number of different management styles:

| Style | Comment |
|---|---|
| Autocratic | Little concern for people |
| Participative | A lot of concern for people |
| Transactional Leadership | Task and responsibilities are clear |
| Transformational Leadership | High goals/values articulated |
| Management by Fact | Decisions based on data |
| Coaching | Helping employees improve |
| Contingency Approach | Exercising management flexibility |

d. Good management requires the manager to understand the different theories and styles of management and apply them depending on the individual/situation being dealt with.

3. *Interdependence of functional areas:*
   a. In general there are two kinds of business functions: external and internal. The external functions deal with such things as regulatory and environmental issues—the "outside world." Internal functions are those operating within the organization such as finance, human resources, marketing/sales, logistics, engineering, research and development, production, and quality.
   b. Good management practices dictate always taking a systems view of the organization so the internal functions operate as an integrated and coordinate whole. A good example is the practice of concurrent engineering when developing a new product/service. Concurrent engineering brings all affected parts of the organization into the planning loop early on so what engineering designs will satisfy manufacturing requirements and result in something marketing can sell.

4. *Human resources (HR) management:*
   a. Although the human resources function typically has most of the responsibility for personnel administration, it must work closely with the other

functional mangers since they also have a part of that responsibility. For
example, managers have an important role to play in the selection, hiring,
assimilation and, when necessary, firing of employees.

b. One of the most important roles for both human resources and each func-
tional managers/supervisor is the development of each employee. Appen-
dix C shows the many factors that are involved in this important task. Note
investing in an employee's development is a mutual effort by both the
manager/supervisor and the individual.

c. One of the most difficult jobs of a manager/supervisor is evaluating the
performance of his/her employees. To do this properly the evaluation sys-
tem must, as Westcott puts it, "be continual, fact based, and founded on
clear, established, and communicated expectations" (p. 176).

d. When staffing the quality function a number of different types of positions
may be needed depending on the size of the organization. Typical titles
include vice-president for quality (in a quite large organization), quality
director, quality manager, quality specialist, quality inspector, etc.

5. *Financial management:*

a. It is important for the quality (or any) manager to learn how to speak the
language of management, namely finance.

b. Financial reporting starts with bookkeeping. There are two methods: cash
basis and accrual basis. The cash basis method books expenses and income
when actually paid/received, the accrual method as soon as these transac-
tions occur regardless of when the cash is actually paid/received. Most
organizations use the accrual method, which better relates expenses with
income.

c. There are three common financial statements: the balance sheet, the profit
and loss (income) statement, and the cash-flow statement. The Securities
and Exchange Commission (SEC) also requires a statement of shareholder
equity.

d. The balance sheet shows an organization's financial condition at a certain
point in time—e.g., on the last day of the quarter or year—in terms of its
assets, liabilities and owners' equity.

e. The profit and loss statement shows the organization's financial perfor-
mance over a certain period—e.g., a quarter or year—in terms of income,
expenses, and the resulting profit (or loss).

f. The cash-flow statement shows the incoming and outgoing cash flows for
the organization over a certain period. This statement is important since it
can show whether the organization has enough cash from internal opera-
tions to meet all its operational and debt requirements.

g. Another way to show information on an organization's finances is the use
of ratios. Here are some examples:

| Ratio | Equals |
|---|---|
| Current Ratio | $\dfrac{\text{Current assets}}{\text{Current liabilities}}$ |
| Acid Test (Quick) Ratio | $\dfrac{\text{Cash + Accounts Receivable}}{\text{Current liabilities}}$ |
| Debt/Equity Ratio (% debt) | $\dfrac{\text{Total iong-term debt}}{\text{Total long-term debt + Total owners' equity}}$ |
| Debt/Equity Ratio (% equity) | $\dfrac{\text{Total owners' equity}}{\text{Total long-term debt + Total owners' equity}}$ |
| Gross Profit Margin | $\dfrac{\text{Gross profit}}{\text{Net sales}}$ |
| Inventory Turnover | $\dfrac{\text{Cost of goods sold}}{\text{Average inventory}}$ |
| Days Receivable Outstanding | $\dfrac{\text{Average accounts receivable}}{\text{Net sales}} \times 365$ |
| Days Payables Outstanding | $\dfrac{\text{Average accounts payable}}{\text{Cost of sales}} \times 365$ |
| Working Cap. /Dollar of Sales | $\dfrac{\text{Average working capital}}{\text{Net sales}}$ |
| Return on Investment (ROI) | $\dfrac{\text{Net dollar benefit}}{\text{Investment (net costs)}}$ |

   h. Ratios provide a useful way to make quick comparisons about various aspects of an organization's finances.

   i. How an organization determines the costs of its products/services is important. The traditional way of allocating costs by some arbitrary factor such as a percentage of direct labor costs is being replaced by activity-based costing (ABC). ABC allocates costs based on the costs of activities actually involved in producing the product or service and is therefore much more accurate.

   j. An organization's budget flows from its strategy and initially is estimated both at the top level (on a macro basis) and within each operating unit (on a micro basis). Usually through an iterative process agreement is reached with top management on the budget for each operating unit resulting in the budget for the whole organization.

6. *Risk management:*

   a. An important part of risk management is first understanding the types of risk an organization can face. These could range from minor such as an

easily corrected manufacturing or supplier error, to major such as the sudden loss of key personnel or serious damage due to an earthquake or fire.

b. Once an organization has identified the most likely types of risks to which it will be exposed it then takes action relative to each type to either eliminate it or minimize its impact should it occur. Risk management actions could be such things as additional insurance coverage, development of contingency plans, and the training of personnel.

7. *Knowledge management:*

a. As knowledge become more important for maintaining a competitive edge so too does its effective management.

b. Knowledge management involves the systematic acquisition and storage of data and information in a way it can be readily accessed and used for creating knowledge and wisdom.

c. Ideally an organization becomes a "learning" organization, using its knowledge to continually gain an every greater understanding of how things work.

**B. *Communication Skills and Abilities*** (III. Management Elements and Methods)

1. *Communication basics:*

a. Good communications occurs when the sender's message is received, understood, *and acted upon* by the receiver. There are many potential barriers to good communication (called filters) such as cultural or language differences, differences in education and experience, and the level of trust that exists between those communicating.

b. Communications within an organization flows vertically (management to subordinate and vice versa) and horizontally (e.g., across functional lines).

c. Communications can be verbal (written or oral) or non-verbal (body language). It is important for the verbal oral message to be consistent with the non-verbal message.

d. Communications can also be formal (e.g., procedures, business letters, etc.) or informal (e.g., discussions or e-mails between peers). One important form of informal communications is the organization's grapevine.

e. The appropriate media for communicating depends on such things as the urgency of the message, the number and dispersion of the intended receivers, and the degree of confidentiality needed.

f. Good questioning can greatly enhance the effectiveness of the communications and is an important skill especially for quality mangers.

g. Good interpersonal skills such as showing empathy, being tactful, and being open minded also contribute to effective communications.

h. Being a good listener is another important communications skill. As Westcott says "It is a truism that we should talk less and listen more" (p. 223).

2. *Communications in a global economy:*

There can be many obstacles to communications in a global economy such as

cultural, language, time, and management style differences. To overcome these obstacles, top management must be willing and committed "to adapt and adopt to new ways of communicating and to integrate those ways with the practices of the organization" (p. 225).

3. *Communications and technology:*

   a. Information technology (IT) has now become a very important factor in organizational communications and applies to three main tasks: operations support, day-to-day decision-making, and strategic analysis.

   b. Examples of the operations support task: keeping track of sales via point-of-sale data entry terminals, a sales person being able to access in real time the amount of stock in inventory, and the monitoring and control of processes.

   c. Examples of the day-to-day decision making task: tracking such things as the sales of each product, how well delivery times are being met, and customer satisfaction to base resource allocation or corrective action decisions on.

   d. Examples of the strategic analysis task: combining the "micro-level" data about such things as sales, customer satisfaction, and financial performance to see how well the strategic goals are being met, and to plan the best way ahead for the organization.

   e. Some important things to consider when setting up the IT system are: the balance between centralization/decentralization, the amount of redundancy that is prudent, the competency of the employees to effectively use the system (what training is required?), and being sure the information gathered by the system is really what needed and is provided when and where it is needed.

   f. Another important consideration is how the information is presented. It should be presented in a way that allows for its most effective use. For example, will a particular type of graphical display be the best way for the intended user to quickly understand what he/she needs to know?

   g. The organization's information system must operate as an integrated whole; i.e., in a way that ensures the vertical and horizontal alignment of the organization's processes and performance measures. In other words in a way that lower-level processes/measures support higher ones and upstream/downstream processes/measures work together.

**C.** *Project Management* (III. Management Elements and Methods)

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1. Projects can be initiated for a variety of reasons; e.g., to achieve some objective dictated by a higher-level strategic goal, in response to an audit finding, or to improve a process.
2. Accordingly, projects can range from relatively simple, short-term (say, one year or less) efforts not involving other functions of the organization to complex, long-term efforts that involve multiple functions or even other organizations.
3. There are five stages to a project's lifecycle:
   1. Visualizing, selling, and initiating the project
   2. Planning the project
   3. Designing the processes and outputs (deliverables)
   4. Implementing and tracking the project
   5. Evaluating and closing out the project

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1. *Project management tools:*
   a. During stage one—visualizing, selling, and initiating the project—such things as risks involved with the project and the project's benefits versus costs are considered.
   b. Very generally a project's benefits-to-costs ratio is the estimated sum of all anticipated benefits (expressed in dollars) over the estimated sum of all anticipated costs. Both direct and indirect benefits/costs should be considered although indirect benefits/costs are often difficult to quantify.
   c. Some common methods for assessing a project's benefits vs. costs and deciding if the project should go forward are: payback period, net present value (NPV), internal rate of return (IRR), potential return on investment (ROI), and estimated return on assets (ROA).
   d. Even if a project shows a very favorable benefits-to-costs ratio it may not be prudent to undertake if it would overtax the organization's resources.
2. *Project planning and estimation tools:*
   a. According to Westcott (pp. 247/8) a typical project could involve as many as 15 planning steps:

| Step | Comment |
| --- | --- |
| 1. Statement | To define problem or opportunity |
| 2. Project justification | Based on benefits vs. costs |
| 3. Drafts | Of mission, scope, objectives |
| 4. Stakeholder requirements | Plus impact of meeting them |
| 5. Project team formation | Selection based on stakeholder representation needed/skill(s) needed |

| 6. Mission statement (updated) | Drafts updated and charter written |
|---|---|
| 7. Deliverables | Includes those for managing project |
| 8. Work breakdown structure | Could include responsibilities and resources required for each task |
| 9. Gantt chart (matrix) | To show estimated start/finish times |
| 10. Time-dependent task diagram | For example CPM or PERT |
| 11. Resource requirements matrix | To show what resources are required when (personnel, materials, etc.) |
| 12. Linear responsibility matrix | To show who has responsibility for what (for larger projects) |
| 13. Project budget | An itemized budget |
| 14. Measurements and reports | How progress/completion determined |
| 15. Completed project plan | Presented for approval sign-off |

b. For smaller projects all 15 steps may not be required or some can be simplified.

c. For step 5—project team formation—anyone who will be responsible for implementation of any of the team's recommendations must be represented on the team.

d. Deliverables (step 7) could include such things as engineering specifications, various plans related to implementation of the project, progress reports, and project documentation for adding to the organization's knowledge base.

e. Although the Gantt chart (step 9) is easy to understand and may be satisfactory for small projects, it doesn't show the interdependencies among project activities that may be required for larger projects. For this, one of the following methods can be used: activity network diagram (AND), critical path method (CPM), or program/project evaluation and review technique (PERT).

f. A resource requirements matrix (RRM) (step 11) ensures that project planning has fully considered what resources are needed and when they are needed. For large projects there might be a RRM for each category of resources such as personnel, facilities, equipment, materials, and consulting services.

g. Other information about resources to be included in the project plan might be: who is authorized to make the resources available, how will they be delivered, what will they cost, and who will pay for them?

h. From the resource requirements documentation (e.g., the RRMs) should

flow the project budget. This could be in the form of detailed costs for each project activity and/or detailed costs broken down by labor and non-labor.

i. The project budget then becomes an important document for getting management's approval of the project and for monitoring and controlling the project as it goes forward.

3. *Measure and monitor project activity:*

a. For stage 3 in the project lifecycle—designing the processes and outputs (deliverables)—the only thing Westcott says is: "The tools used in designing the processes and deliverables will depend upon the type of projects planned" (p. 263).

b. For stage 4—implementing and tracking the project—several important performance measures come into play such as those tracking the following: the timeliness of completion of scheduled activities, budget variances, and resource usage.

c. Another important tool is one that allows the project manager to continually assess any potential risks—such as not meeting the scheduled completion date—so contingency plans can be developed/updated.

d. For stage 5—evaluating and closing out the project—some typical measures include deliverables achieved, how well the schedule and budget were met, operational improvements (e.g., reduced cycle time), and lessons learned. In fact, there could be many more depending on the project.

4. *Project documentation:*

a. Good project documentation serves several purposes such as helping ensure the project is well managed, providing a way to communicate the project's status to all concerned, keeping the project's records up to date, and providing information that can be used for future project planning (e.g., lessons learned).

b. A post-project audit/assessment may be used to compare the project's anticipated results with what actually happened. This can occur both shortly after the project finishes and/or over an extended period thereafter.

### D. *Quality System* (III. Management Elements and Methods)

1. The answer to the question "What is quality?" depends on how quality if viewed. For example, one view of it could be based on any of several common definitions such as Crosby's "conformance to requirements" or Juran's "fitness for use."

2. Another view could be in terms of whether the organization is truly customer-focused, whether it believes in designing quality into the product/service vs. "inspecting it in," and if quality is part and parcel of its strategy.

1. *Quality mission and policy:*
   a. The mission of the quality management function is to ensure that (1) the organization's mission has a customer and quality focus, (2) all suppliers/ employees understand the basic principles of quality and how to apply them, and (3) all employees have and know how to use the tools needed to deliver quality products/service.
   b. The quality management function should both influence the organization's mission and be a reflection of that mission in terms of what is emphasized; e.g., timeliness over cost. That is, there should be a close linkage between the quality management function's mission statement and that of the organization as a whole.
   c. As mentioned in section II.C (Strategic Plan Deployment), the quality manager plays a major role in the strategic planning process that includes development of the quality policy, quality management principles, and strategic quality objectives.
   d. The effectiveness of the organization's quality policy is measured by how well the quality-related objectives are achieved. And this, in turn, is determined by how well the quality policy is backed by top management.
2. *Quality planning, deployment, and documentation:*
   a. The quality plans of an organization exist at two levels: those at the highest level, which form a part of the overall strategic plan, and those at the operating level.
   b. Those at the strategic level provide guidance for the development of each function's operating-level quality plans.
   c. To quote Westcott (p. 280): "The operating-level quality plan translates the customer requirements (the what) into actions required to produce the desired outcome (the how) and couples this with applicable procedures, standards, practices, and protocols to specify precisely what is needed, who will do it, and how it will be done."
   d. As the product/service is produced there may be additional documentation such as inspection results, customer certifications, etc. that, when associated with the quality pan, become a record of how well the plan was accomplished.
3. *Quality system effectiveness:*
   a. Tools for evaluating the effectiveness of an organization's quality system fall into two categories: macro-level and micro-level.
   b. Examples of macro-level evaluation tools are:

| Balanced Scorecard |
| --- |
| Baldrige Application Self-Analysis Worksheet (goggle Baldrige) |
| ISO 9004:2000 Quality Management Systems—Guidelines for Performance (see its Annex A) (goggle ISO 9000) |

| ISO 9004 Assessment Criteria Checklist for Performance Improvement (CD available from ASQ) |
| --- |

c. Examples of micro-level evaluation tools are:

| Quality audits |
| --- |
| Managing by Walking Around (MBWA)—This is an informal look at the organization's quality system by a senior manager. He/she could follow an order from receipt to delivery, look at a specific function (e.g., order processing) or simply walk through a part of the organization asking questions. |
| Management reviews |
| Skip-level meetings. Here a senior manager will meet with a person two or more levels below without the intervening manager(s) to get direct feedback on how the quality system is perceived. |
| Cost of quality measures |
| Return on quality investments |

E. **Quality Models and Theories** (III. Management Elements and Methods)

| An organization needs a well-structured system (model) to manage its quality-related activities. The most commonly used models are the Baldrige National Quality Program (BNQP), the Deming Prize, and the ISO 9000 series standards. |
| --- |

1. *Baldrige National Quality Program (BNQP) criteria for performance excellence:*
   a. The BNQP criteria for performance excellence are based on seven categories of activities working together as a system within the context of an organizational profile:
       1. Leadership
       2. Strategic Planning
       3. Customer and Market Focus
       4. Measurement, Analysis, and Knowledge Management
       5. Workforce Focus
       6. Process Management
       7. Results
   Appendix D provides more information on these seven categories and how they interrelate. A prize is awarded annually to organizations that meet the program's stringent requirements.
   b. Other major quality award programs are: the European Quality Award, the Deming Prize (a Japanese program), and the Shingo Prize for Excellence in Manufacturing (to promote lean manufacturing).

2. *ISO and other third-party standards:*
   a. The ISO 9000 series consists of these three publications:

   > ANSI/ISO/ASQ Q9000-2000: *Quality management systems—Fundamentals and vocabulary.* As the name implies, covers fundamentals and terms/definitions.
   >
   > ANSI/ISO/ASQ Q9001-2000: *Quality management system—Requirements.* The standard against which an organization is audited to obtain ISO 9001 certification.
   >
   > ANSI/ISO/ASQ Q9004-2000: *Quality management systems—Guidelines for performanance improvement.* A comprehensive set of guidelines to help an organization go beyond the minimum requirements of the ISO 9001 standard.

   b. As with the Baldrige criteria, the ISO 9001 standard lays out the requirements for a good quality management system in general terms. It is up to the organization to adapt it to its particular situation.
   c. The ISO 9001 standard is based on eight quality management principles:
      1. Customer focus
      2. Leadership involvement
      3. Involvement of people at all levels
      4. Process management
      5. System approach to management
      6. Continual improvement
      7. Fact-based decisions
      8. Mutually beneficial supplier relationships
   d. The requirements of ISO 9001 are grouped according to these five areas:
      1. Quality management system
      2. Management responsibility
      3. Resource management
      4. Product realization
      5. Measurement, analysis, and improvement
   e. There are many other ISO 9000-related standards such as: ANSI/ISO/ASQ Q190115-2004: Guidelines for Quality and/or Environmental Management Systems Auditing, ISO/TS 16949-2002: Quality Management Systems (requirements for applying ISO 9001 to automotive production), SAE AS9100-2001: The International Aerospace Quality System Standard, and ANSI/ISO/ASQ E14001-2004: Environmental Management Systems.

3. *Other quality methodologies:*
   a. Other quality methodologies include total quality management (TQM) and continuous quality improvement (CQI).
   b. To quote Westcott (p. 304): TQM is a "management system for a customer-focused organization that involves all employees in continual improvement of all aspect of the organization." Its primary elements are:
      1. Customer-focused

    2. Total employee involvement

    3. Process-centered

    4. Integrated system

    5. Strategic and systematic approach

    6. Continual improvement

    7. Fact-based decision-making

    8. Communications

c. These elements, for the most part, are also those upon which the Baldrige criteria and the ISO 9001 requirements are based.

d. Subsets of the continuous (or continual) quality improvement methodology are: kaizen, Six Sigma, and benchmarking.

e. Kaizen is a Japanese word meaning continual improvement. One of the most common applications of this concept is the kaizen event (sometimes called kaizen blitz). A kaizen event is a team effort typically over a five-day period to carry out a specific quality improvement project. Examples might be reconfiguring a workplace to make it more efficient or changing a process to reduce its cycle time.

f. The Six Sigma methodology is used to reduce variation in a production process so the number of defects is essentially zero.

g. When benchmarking, an organization studies the processes of a world-class organization to see how it can improve it own similar processes. The processes need not be identical as long as there is some essential commonality.

4. *Quality philosophies:*

a. Some of the major contributors to quality and some of their key ideas/contributions are:

| Major Contributor | Some of Their Key Ideas/Contributions |
|---|---|
| Philip B. Crosby | Quality is conformance to requirements, "zero defects" is the only performance standard, to prevent non-conformance companies need a "vaccine" composed of determination, education, and implementation. |
| W. Edwards Deming | His 14 Points, the seven deadly "diseases," and his system of profound knowledge. |
| Armand V. Feigenbaum | Total quality control (TQC), which is "excellence" (vs. "defect") driven and supported by: quality leadership, quality technology, and organizational commitment. Cost and quality are complementary. |
| Kaoru Ishikawa | TQC is everyone responsibility and is a team activity, quality over short-term profits, quality circles, and the cause-and-effect diagram. |

| | |
|---|---|
| Joseph M. Juran | The Quality Handbook, his trilogy (quality planning, control, and improvement), the three levels of quality management: strategic, operational, and workforce, and the diagnostic and remedial journeys of the universal sequence. |
| Walter A. Shewhart | Statistical quality control, two types of causes of variation (chance and assignable), the plan-do-check-act (PDCA) cycle. |
| Genichi Taguchi | The efficient use of design of experiments, quality is "the (minimum) loss imparted by a product to society..." (the Taguchi loss function). |

## IV. Quality Management Tools

**A. *Problem Solving Tools*** (IV. Quality Management Tools)

Problem-solving tools provide a systematic means for both analyzing the problem and coming up with a solution in the most creative and efficient way.

1. *The seven classic quality tools:*
   a. The seven classic quality tools are:
      1. Flowchart
      2. Check sheet
      3. Cause-and-effect diagram
      4. Pareto chart
      5. Control chart
      6. Histogram
      7. Scatter diagram
   b. A *flowchart* allows all the steps in a process to be graphically displayed showing interrelationships and decision points (see also section IV.B.2 Process Analysis below). A flowchart example is at Appendix E.
   c. A *check sheet* is simply a way to tally the number of times something occurs, for example the different types of defects causing a particular part or product to be rejected.
   d. A *cause-and-effect diagram* (also known as an Ishikawa or fishbone diagram) lays out all the possible causes for a particular problem. The causes are usually grouped according to some system such as the four Ms* for a manufacturing processes or the four Ps** for service processes.
      *Manpower, machinery, methods, and materials.
      **People, policies, procedures, and plant.
   e. A *Pareto chart* takes data—e.g., types of defects or downtimes of

machines—and groups it according to frequency of occurrence. When graphically displayed this way it is easy to see which defect or machine is contributing the most to the problem.

f. A *control chart*, using periodically gathered sample data from a process, shows how far each sample deviates from the desired norm. By setting mathematically derived upper and lower control limits, unacceptable variation can be quickly spotted. Control charts help to both detect special (one-time) causes of variation and show how the process performs over the long-term. Figure 1 in Appendix G is an example of a control chart.

g. A *histogram* is a frequency distribution diagram showing how often a certain nominal process value occurs over time. It can show if two or more distributions are actually present due to different inputs to the process.

h. A *scatter diagram* plots the relationship (correlation) of two variables to each other; e.g., the curing temperature of a glue joint and its shear strength. Such a plot will also show if the relationship is positive or negative and how strong it is. Because two variables are correlated does not mean there is a cause-and-effect relationship!

2. *Basic management and planning tools:*

a. The seven classic quality tools are used to analyze processes, the follow seven tools are used more for planning and managing activities:
   1. Activity network diagram
   2. Affinity diagram
   3. Interrelationship digraph
   4. Matrix diagram
   5. Priorities matrix
   6. Process decision program chart
   7. Tree diagram

b. An *activity network diagram (AND)* is a way to lay out all the activities of a project to show how they relate to each other. It includes the critical path method (CPM) and program evaluation and review technique (PERT).

c. An *affinity diagram* is used to group similar ideas—e.g., those generated in a brainstorming session—into meaningful clusters for further study. It can help the group come to a better common understanding of what the ideas mean.

d. An *interrelationship digraph* shows cause-and-effect relationships between ideas. For example, suppose an affinity diagram has been used to group similar ideas about, say, things that impact team performance. The interrelationship digraph would then be used to see if there are any logical cause-and-effect relationships between idea clusters and, if so, the direction of the relationship (one-way or both directions).

e. A *matrix diagram* is another way to show how two sets of data are related. One set of data is represented by the rows and the other set by the columns.

If a relationship exists between any of the data elements it is indicated by some mark or symbol placed at the intersection of that row and column. A number or special symbol could be used to indicate the strength or significance of the relationship. Matrix diagrams are typically used to help develop an interrelationship digraph or to show the involvement of various parts of an organization in each task of a project.

f. A *priorities matrix* is used to analyze several options one might have in choosing some product—say a new car—against a set of criteria. By appropriately weighting each significant attribute (e.g., handling, acceleration, etc.) in terms of importance, and then assigning an "objective" value to the attribute for each possible choice (each car), a final matrix can derived showing, for each possible choice, a number that combines importance with the objective value of the attribute. Theoretically the possible choice (car) with the highest total for all the attributes is the best. Westcott's car example is shown in Appendix F.

g. A *process decision program chart* is used to show for each task of a project the things that could go wrong and, for each thing that could go wrong, one or more contingency plans. It is especially helpful for new projects for which there is little experience.

h. A *tree diagram* breaks down an objective or problem into more and more detail much like a work breakdown structure. A tree diagram is a way to analyze an objective to see what needs to be done or to analyze a problem to determine its cause(s).

3. *Process improvement tools:*

   a. In this section Westcott discusses the following process improvement tools:
      1. Root cause analysis
      2. The plan, do, check, act/plan, do, study, act (PDCA/PDSA) cycle
      3. Supplier-input-process-output-customer (SIPOC) analysis
      4. Six Sigma and the define-measure-analyze-improve-control (DMAIC) model
      5. Failure mode and effects analysis (FMEA)
      6. Statistical process control
      7. Pre-control
      8. Process improvement model

   b. There are two approaches to *root cause analysis*: the seven-step problem-solving model and the five whys.
      (1) These are the seven steps of *the problem-solving model*:
          1. Identify the problem
          2. List possible causes
          3. Search out the most likely root cause
          4. Identify potential solutions
          5. Select and implement a solution

   6. Follow up to evaluate the effect
   7. Standardize the process

(2) The *five whys* method is simply continuing to ask why about a problem's causes until the actual root cause is revealed. For example a leaking pipe is caused by poor maintenance, is caused by not enough maintenance personnel, is caused by poor management, etc. There could be multiple first-level causes for a problem and, for each of these causes, more than one cause at the second-level and so forth.

c. The *PDCA/PDSA cycle* is a very simple yet powerful way to view process improvement. First you plan what you want to do by designing a product or service and setting up the process to provide it. Second you carry out the process. Third, you check/study the results—usually in terms of acceptability to the intended customer. And finally, using what you've learned from the third step, you improve the product/service and/or process.

d. *SIPOC analysi*s is used to understand an existing process better so it can be improved. Once the five parts of the process—supplier, input, process, output, and customer—have been identified, such things as the adequacy of the evaluation and control measures can be determined for possible improvement actions.

e. *Six Sigma's* purpose is to produce a product that is essentially defect-free. It involves the following five steps referred to as *DMAIC*:
   1. Define the requirement
   2. Measure what is critical to quality
   3. Analyze the process to determine its capability
   4. Improve the process
   5. Control the resulting improved process

f. *Failure mode and effects analysis (FMEA)* is used to identify the ways a product or process could fail, especially a new product or process for which there is little experience. It involves assessing the severity, likelihood of occurrence, and likelihood of detection so the potential failures (risks) can be prioritized and dealt with through preventive and corrective actions.

g. *Statistical process control* is used to analyze and monitor the variation in a process over time. This is done by periodically sampling data related to the process; e.g., the number of defective units. The sample data is recorded on a control chart, which also shows upper and lower control limits. As long as the data meet certain criteria for randomness the process is considered to be under control. Should the variation begin to exceed the control limits and/or show a trend, the presence of some underlying special cause of variation is indicated and the process is out of control and corrective action needs to be taken. See Figure 1, Appendix G for an example of a control chart.

h. Typically *pre-control* is useful with new processes where there is not enough data to determine statistically valid control limits. Instead the specification limits are set in terms of zones: green (good), yellow (may be a problem), and red (defect present).

i. The *process improvement model* consists of these five steps: select process, review current performance, identify improvement opportunities, implement improvements, and evaluate progress.

j. Regardless of the improvements being made, they should be based on certain principles such as senior management oversight, a strategic and customer focus, data-based decision-making, and prevention over corrective actions.

4. *Innovation and creativity tools:*

a. Problem solving often requires not only analytic skills but also creativity to come up with new ideas. Tools to aid creativity include:
    1. Brainstorming
    2. Mind mapping
    3. Analogies
    4. Nominal group technique
    5. Multivoting
    6. Lateral thinking
    7. Critical thinking
    8. Design for manufacturing (DFMA) and design for Six Sigma (DFSS)
    9. TRIZ
    10. SCAMPER
    11. Storyboard

b. *Brainstorming* is used to get ideas for something such as solving a problem. A group is assembled and asked for ideas. Any idea, no matter how strange, is okay and accepted without comment by the others. When no more ideas are forthcoming, the list of ideas is then evaluated and reduced to a smaller set for final selection. The ideas can also be solicited anonymously.

c. *Mind mapping* is used to help expose all the issues that might be relevant to an objective. The objective is written down and then each major related issue is identified and written down as a "spoke" off of the central objective. Then each major issue is treated the same with related sub-issues written down around that major issue.

d. *Analogies* allow a group to see a problem from a wholly different perspective. Westcott uses the example of getting ideas for the design of a new gardening tool after randomly selecting the phrase "soaring like an eagle" for the analogy; Figure 2 in Appendix G is the result. If one analogy doesn't seem to be working another one is selected and tried.

e. *Nominal group technique* is a good way to reduce the number of ideas a group has come up with (say from brainstorming). First any similar ideas

are combined. Then each member of the group ranks the ideas—for example, from 1 to 10 with 10 being the best. Finally the rankings are totaled up and the ideas receiving the highest rankings are selected.

f. *Multivoting* is another way to reduce the number of ideas. Members are asked to pick those ideas they think are best—say about half of the total number of ideas. These ideas are then tallied and the ideas that were least preferred are dropped from the list and the process repeated until a small enough number is reached.

g. *Lateral thinking* is a way to force the brain to think in a certain way; e.g., by the use of Dr. deBono's six thinking hats*. Each "hat" is a different color representing a certain way of thinking. For example the when "wearing" the white hat you are to think objectively ("just the facts"), when wearing the yellow hat think optimistically with a "can do" spirit, etc.

　　*Not real hats, of course.

h. *Critical thinking* is a way to approach a problem by the use of good reasoning—both deductive and inductive—and from both an analytical and systems view of things. Typical of critical thinkers is inquisitiveness, truth-seeking, and open-mindedness.

i. *Design for Manufacturing (DFMA)* is a methodology that attempts to make the design of a product as compatible with the production process as possible to minimize the need for subsequent design changes. It does this mainly through standardization and simplification.

j. *Design for Six Sigma (DFSS)* brings statistical techniques to DFMA such as "analysis of tolerances, mapping processes, development of a product scorecard, design to unit production costs (DTUPC), and design of experiments (DOE)" (p. 363). As inferred by the name, the goal is to design a product that can be delivered with Six Sigma quality.

k. *TRIZ* is a Russian acronym standing for "the theory of the solution of inventive problems." It is a set of tools and principles for letting the average person engage in out-of-the-box thinking characterized by the way inventors think.

l. *SCAMPER* is a way to stimulate creative thinking using these seven questions:

| S | What can be used as a *Substitute*? |
| C | What can be *Combined* with _____ ? |
| A | How can _____ be *Adapted*? |
| M | How can _____ be *Modified*? |
| P | How can _____ be *Put* to other uses? |
| E | How can _____ be *Eliminated*? |
| R | What if _____ were *Reversed* or *Rearranged*? |

   m. *Storyboard* is a way for a team to display all the ideas it has generated (e.g., through brainstorming) pertinent to solving the problem it is working on. Typically the ideas are represented in words and/or pictures and are posted on a storyboard in a way that logically shows how they relate to each other and the problem to be solved. The storyboard gradually evolves as more ideas are developed and existing ideas modified until the team is finally satisfied with the arrangement.

5. *Cost of quality (COQ):*
   a. The final problem-solving tool in this chapter of Westcott (Chapter 13) is cost of quality (COQ). COQ might better be termed a way to identify and prioritize improvement opportunities to which other problem-solving tools can be applied. A COQ program seeks to identify all the costs associated with poor quality. Four categories of costs are tracked:

| |
|---|
| *Internal failure costs*: The costs incurred before the product is delivere to the customer; e.g., the costs of nonsalvageable bad product, rework, etc. |
| *External failure costs*: The costs incurred after the product is delivere to the customer; e.g., the costs of handling customer complaints, replacements, lost good will, etc. |
| *Appraisal costs*: The costs of ensuring the product meets established standards and performance requirements; e.g., various inspections and tests, calibration of testing equipment, etc. |
| *Preventions costs*: The costs incurred to minimize the appraisal and failure costs; e.g., the costs of maintaining a good quality management system, costs for quality education and training, etc. |

   b. These costs are methodically and as accurately as possible tracked. Those areas showing the largest costs (especially failure costs) become candidates for quality improvement initiatives.

**B. *Process Management*** (IV. Quality Management Tools)

| |
|---|
| 1. A process is a set of related actions that transform an input into a desired output. It adds value to the input and provides the output to an intended customer. |
| 2. In general a process differs from a system in that a system has "its own self-serving objectives" (e.g., an accounting system) while a process "aims at transforming inputs into outputs to achieve (ultimately) the strategic objectives of the organization" (pp. 372/3). |
| 3. Process management includes setting goals, establishing controls, and measuring and improving performance. |

1. *Process goals:*
   a. Process goals are connected to the organization's strategic plan and each

goal is supported by one or more process objectives.

   b. Each process objective should be specific and measurable; e.g., reduce the number of defects in a certain product by 50% in the next six months. Note: This objective might be supporting a more general goal of improving customer satisfaction.

   c. Some generic areas that process goals would typically address include exceeding customer requirements, being sure the process contributes to the organization's profits, being sure a product/service is safe and does not harm the environment, and the continual improvement of the process.

   d. Once the more specific process objective has been established, it will then have its supporting procedures/process to meet the objective.

   e. The key to successful process objective achievement is the setting and systematic monitoring of clear metrics.

2. *Process analysis:*

   a. Reasons for analyzing a process include identification of non-value-added steps or simply to better understand the process.

   b. The primary method for analyzing a process is the flowchart/process map.

   c. In general these are the steps to be followed for mapping a process:

      1. Decide on what process to map.
      2. Define reasons for mapping.
      3. Decide on the type of map (style); e.g., grid* or nongrid.
      4. Define the process by determining such things as inputs, outputs (e.g., customer requirements), departments involved, titles of those involved, constraints, etc.
      5. Map the process, first without exceptions and then with decision points and alternative paths.
      6. Review map with knowledgeable persons and revise as needed. The review(s) can be off-site and/or at the site of the process.

     *A grid map is laid out by responsible department.

   d. Initially the mapper will probably work with simple pencil and paper notes, eventually moving to a more formal depiction using pen and ink or some software application. Appendix E is an example of a flowchart/process map.

   e. Process maps are but one part of the organization's total documentation which will also include such things as procedures, work instructions, and records.

   f. Ideally the organization's quality/business plan will reference the key, top-level procedures that, in turn, will reference associated work instructions and records to be kept.

   g. Other organizational documentation includes control plans, which address quality characteristics for a specific product/service, and industry-specific documentation such as that called for from automotive suppliers by ISO/TS16949.

3. *Lean tools:*
   a. One of the best ways to improve processes is the use of lean tools. Lean tools can be generally classified as follows:

   | | |
   |---|---|
   | Cycle-time reduction | Just-in-time |
   | Value stream mapping | Takt time |
   | Five S | Line balancing |
   | Visual management | Standardized work |
   | Waste reduction | Single-piece flow |
   | Mistake-proofing | Cellular operations |
   | Setup/changeover time reduction | Concurrent engineering |
   | Total productive maintenance | Outsourcing |
   | Kaizen blitz/event | Business process reengineering |
   | Kanban | |

   b. *Cycle-time reduction* attempts to minimize the total time to complete a process. There are many ways to reduce cycle time but the basic idea behind them is to eliminate non-value-adding activities, usually by employing one or more of the following lean tools.
   c. *Value-stream mapping* charts "the sequence of movements of information, materials, and production activities in the value stream (all activities involving the designing, ordering, producing, and delivering of products and services to the organization's customers)" (p. 390). By seeing this overall picture, communications among those involved along the value stream is improved plus areas of non-value-adding activity become apparent and targets for elimination. Figure 3 in Appendix G is an example of a partial value-stream map at the plant level.
   d. *Five S* is a simple program for making the workplace much more efficient. It consists of five steps originally described by five Japanese words that can be translated as follows:
      • *Seiri* (sort): Sort the stuff you actually use from that you don't use and get rid of the latter.
      • *Seiton* (set in order): Arrange things for their most efficient use; e.g., tools on a shadow board, dies in a designated and convenient place, etc.
      • *Seiso* (shine [clean]): Keep everything spic and span.
      • *Seiketsu* (standardize): Set up procedures to keep everything orderly and clean.
      • *Shitsuke* (sustain): Ensure the procedures continue to be followed.

e. *Visual management* is the use of any sort of visual aid to enhance efficiency and safety or to prevent errors. Examples include a shadow board that keeps tools where they can always be found or an electronic status board to show when there is a problem on the assembly line.

f. *Waste reduction*. Westcott lists seven types of waste:

1. *Overproduction*: Incorporating more into the product than the customer actually requires or wants.

2. *Waiting*: Where one part of a production process is being held up by another part—indicates poor process design.

3. *Transportation*: The inefficient transport of materials and/or work-in-process likely due to a poor plant layout.

4. *Processing*: Basically a poorly designed and therefore inefficient process with too much non-value-added activity.

5. *Excess inventory*: Having more inventory than really needed. This may be due to a "batch and queue" mentality or overproducing some part/subassembly to compensate for an unreliable machine.

6. *Wasted motion*: Unnecessary motion such as bending, reaching, walking, etc. due to poor workplace layout.

7. *Defective parts*: such parts cause waste by having to be reworked, scrapped, sold at a discount, etc.

g. Westcott also groups waste according to visible and invisible. Examples of visible waste are: rework, scrap, and downtime. Examples of invisible waste are: wait time due to an assembly line not being properly balanced, overproduction, and unnecessary reports.

h. *Mistake-proofing* is known as poka-yoke in Japanese and is anything done to prevent an error. For example, if two parts go together, mistake-proofing will cause them to be designed so that there is only one (and correct) way they can be assembled.

i. *Setup/changeover time reduction* is also called "single-minute exchange of die" or SMED since an obvious application is of this "tool" is to minimize downtime between die changes on a production machine. Westcott provides an extensive list of steps for improving setup/changeover times based on the PDCA cycle (pp. 398/9).

j. *Total productive maintenance* means doing everything reasonably possible to keep the production equipment and facilities in top operating condition. Besides a good preventive maintenance schedule, it involves training the operators to do some of the maintenance and to know what to look for if something needs maintenance personnel attention.

k. *Kaizen blitz/event\** is an intensive short-term effort to radically improve some part of the organization's production/service process. A typical kaizen blitz lasts five days (Monday–Friday). Once the target improvement is identified, a team is carefully selected, mostly those involved with the

process, and given appropriate training. Then the team collects data, plans the improvement, and carries it out. Ideally the event will serve as a learning vehicle for those involved so that what was accomplished is sustained and even continually improved. Examples might be to improve the layout of a workplace to reduce wasted motion or to make a workplace clean and orderly and thus more efficient.

　*Also mentioned under III. E. 3 above.

l. *Kanban* is part of the just-in-time inventory system (see next) and involves the use of a signal of some sort to let the upstream supplier know additional supplies are needed at some production point. For example a parts bin, once empty, is sent back to the upstream supplier signaling the need to be refilled and returned. There is usually a card associated with the replenishment action detailing what is required and, indeed, kanban means signboard (card) in Japanese.

m. *Just-in-time* is closely related to kanban and means material is made available to the production system just when it is needed. It requires a lot of coordination with external suppliers including ideally using suppliers whose quality is so good incoming inspections are not required.

n. *Takt time* "is the total work time available (per day or per shift) divided by the demand requirements (per day or per shift) of customers" and "establishes the production pace relative to the demand" (p. 401). Its obvious benefit is matching supply and demand to minimize the chance of either producing more than needed or not being able to satisfy customer demand.

o. *Line balancing* is "proportionately distributing workloads within the value stream to meet takt time" (p. 402). The idea, as implied by the name, is to be sure each part of the production process is working at full capacity versus some parts being overworked and other parts underworked or even often waiting for work.

p. *Standardized work* means developing and continually improving the best way to carryout each part of the manufacturing (or service) process. Toyota is famous for its use of this tool.

q. *Single-piece flow* is the opposite of batch and queue where individual parts are made in large batches and then placed in wasteful inventories until used. With single-piece flow the product/subassembly is made one unit at a time. This method has many advantages such as reducing work-in-process inventories, eliminating wait times, and allowing quality problems to be detected quickly and early on.

r. *The Cellular operations* "tool" is closely related to single-piece flow by designing a work cell for completion of a single unit of a product or major subassembly. Figure 1 in Appendix H shows a typical U-shaped work cell. Such a layout is also designed to minimize waste such as that from wasted motion, wasted transport, waiting time, etc.

s. *Concurrent engineering* is a way to enhance the product and production process design effort such that the number of problems occurring later will be minimized. All "stakeholders"—e.g., marketing, design, and production—are involved.

t. *Outsourcing* should be considered if what is to be outsourced could be better done by another organization. It will often let the outsourcing organization concentrate more fully on it core business.

u. As Westcott puts it "*business process reengineering* may be viewed as cycle-time reduction on a grand scale (macro level)" (p. 404). In other words it involves a start-from-scratch redoing of individual processes or even those of the entire organization. As such it must be carefully considered and executed due to the potentially deleterious affect it could have on morale.

4. *Theory of constraints (TOC):*

a. The theory of constraints (TOC) is a way to look at an entire organization as a system. It is the brainchild of Eliyahu Goldratt whose popular and highly readable book, *The Goal* (first published 1984), is largely responsible for making the TOC well known.

b. Some of the basic principles underlying the TOC are:
   - Treat the whole organization as a system.
   - The system can be likened to a chain, which is only as strong as its weakest link. This weakest link is the system's constraint.
   - Until the system's constraint is addressed, there can be little improvement to the system.
   - It is important to follow the flow of money.*
   *The TOC does this using explicitly defined "throughput," "inventory," and "operating expenses."

c. The basic steps for improving the system are:
   1. Identify the weakest link (constraint) and determine if it is due to a physical or policy cause.
   2. Try to get more capability from the constraint without making expensive changes.
   3. Unless #2 eliminated the constraint, adjust the system to let the constraint operate at its maximum efficiency.
   4. If #2 and #3 are still not sufficient, carry out whatever major changes are needed to eliminate the constraint.
   5. Once the constraint is eliminated, move on to the next constraint (weakest link) and repeat the steps. (Note: this is a never-ending process.)

**C.** *Measurement: Assessment and Metrics* (IV. Quality Management Tools)

> 1. To be effective, an organization needs feedback on its performance. For example, how well are its processes working and are its products/services meeting customer expectations?
> 2. In general, statistics is the tool for understanding performance data. As Westcott succinctly puts it: "Statistics is the science of turning data into information" (p. 417).
> 3. In general the keys to an effective measurement system are (1) knowing the exact purpose of the data and (2) ensuring the data source will continually provide reliable data. For example, what decisions will be made based on the data, are the measurement methods good, and are any devices involved properly calibrated?
> 4. Although most data is quantitative, qualitative data is often also important for measuring organizational performance.

1. *Basic statistical use:*

    a. When developing a process performance measure it is good to use a checklist such as presented by Westcott on pp. 417/8. For example, is the measure easy to understand and use, verifiable and repeatable, and does it really measure what it is suppose to measure?

    b. A technique known as goal-question-metric (GQM) may be a useful approach to develop a measurement system. See p. 418 in Westcott.

    c. It is important to understand the independent variables that drive organizational performance measures of interest. For example, if customer retention is one of the key performance measures, it would probably depend on among other things the timeliness and correctness of the service; and these, in turn, on the independent variables of the amount of training given service personnel and the scheduling system.

    d. To establish a good process measurement system the organization needs to (1) identify those things that are critical to customer satisfaction, (2) map the process to determine which functions are involved, (3) identify the resources and competencies key to meeting the things identified in (1), and (4) set up measures to track and mange those key resources/competencies.

    e. With regard to project management there are at least two things that need to be monitored with appropriate measures: (1) the project planning and management process and (2) the project deliverables.

    f. How metrics are used within an organization can have either a positive or negative affect on those involved. For example using them as a way for controlling people versus identifying areas for continual improvement would have a negative affect.

    g. Ideally the measurement system will allow the organization's workers to be in self-control by making clear what they are to do, letting them know

how well they're doing, and giving them the ability to influence things if they're not meeting organizational expectations.

2.  *Sampling:*

   a.  Sampling may not always be required; for example if the number of items involved is small or self-inspection by trained workers is sufficient.

   b.  Factors that need to be taken into account depending on the purpose of the sampling include: random sampling of the whole populations versus stratified sampling, the sample size (depends on confidence desired), and rational subgrouping (to reduce variability).

   c.  Acceptance sampling is applied to a batch of material to see if a given level of nonconformance is exceeded or not. It is used to see if it is OK to pass the material to the next process or for accepting material from a supplier.

   d.  A fundamental sampling concept is the amount of risk that is acceptable for both the producer and the consumer. Producer risk is the chance that good product will be rejected based on the sampling results and consumer risk is the chance that bad product will be accepted. A sampling plan will be based on specified risk levels for a certain sample size.

3.  *Statistical analysis:*

   a.  There are two basic things that are usually of interest when analyzing sample data: what is the data's central tendency (e.g., average) and what is the data's variability (i.e., its spread)?

   b.  Common measures of central tendency are the data's average (mean), median, and mode. Common measures of variability are the data's range and standard deviation.

   c.  For comparing these measures tests exists such as the t-test for comparing means and the F-test for comparing standard deviations.

   d.  Meaningful statistical analysis of sample data depends on knowledge of how the population data is distributed. For this various probability distributions are used "depending on the type of data (for example, discrete versus continuous data) and characteristics of the process that produces the data" (p. 428). The most common distribution is the normal (bell-shaped) distribution; others include: exponential, Weibull, Poisson, binomial, and hypergeometric.

   e.  Some advanced statistical methods for analyzing sample data are: design of experiments (DOE), linear regression, analysis of variance (ANOVA), and response surface.

4.  *Trend and pattern analysis:*

   a.  Trend analysis is simply examining data over time to see what can be learned from it. As for all data collection, a clear purpose for the analysis should exist such as tracking defects or customer complaints.

   b.  Some of the tools that help organize data for trend analysis are: Pareto charts, check sheets, histograms, control charts, and run charts.

    c. Long-term trend analysis focuses on performance of the organization as a whole and provides information for planning and checking on how well strategic goals are being met.

    d. Short-term trend analysis focuses on work processes. Depending on the scope of the process, instructions for when to do the analysis, what constitutes acceptable performance, and what to do about unacceptable performance can be contained in organizational policy or in work instructions. At the work-instruction level the process operator would normally be expected to eliminate any special causes of variation (see "e" below).

    e. Besides the usual trend patterns of increasing, decreasing and staying the same, "cyclical" and "shift" patterns may occur. These special patterns may be normal, such as seasonal changes, or indicate an abnormality that needs investigation.

    f. Data mining can reveal information useful for quality improvement. Westcott lists several analysis methods related to data mining on p. 434.

    g. Successful trend analysis depends on timely data, and the knowledge and authority to interpret and effectively respond to the trend. This latter item requires a good understanding of the theory of variation.

5. *Theory of variation:*

    a. Variation is a fact of life and exists to some degree in all processes and products. The idea is to minimize it for good quality; i.e., we want whatever we're producing to be as close to some desired standard as possible every time.

    b. The following influences are normally considered the main sources of variation in a process or product: people, machinery, environmental, material, measurement, and method.

    c. There are two types of causes of variation: common causes and special causes.

    d. *Common causes* are due to the design of the process; for example the quality of the input material, the amount of worker training, or the type and quality of the machinery used. These causes are stable and predictable and only management can change them.

    e. *Special causes* are due to some temporary condition such as a machine going out of adjustment, an untrained worker filling in, or unusual weather. Workers can be trained to identify and eliminate or compensate for these causes.

    f. The ideal approach to improving any process is to first bring it under control by eliminating the special causes of variation. Then begin working on the common causes to minimize the inherent variation.

    g. A common problem is when an organization mistakes common causes of variation, which are inherent to the process, for special causes. Applying inappropriate fixes to the common causes, known as tampering, will almost

always make things worse.

h. Control charts provide a way to detect and monitor special causes by showing when a process goes, or starts to go, out of control. See Figure 1 in Appendix G for an example of a control chart. In general, if the sample data goes beyond the chart's upper or lower control limits an "out-of-control" condition is indicated.

6. *Process capability:*

a. Process capability measures (indices) determine if a stable process can operate within the required range of the specification limits. Two common indices are $C_p$ and $C_{pk}$:

| Index | Purpose | Formula |
|---|---|---|
| $C_p$ | To tell how the width of the process compares with the specification range. | $C_p$= (upper spec limit–lower spec limit)/6 sigma |
| $C_{pk}$ | To tell if the process is centered well enough so too much doesn't fall outside the specification range. | $C_{pk}$= (upper spec limit–process average)/3 sigma<br>or<br>$C_{pk}$= (lower spec limit–process average)/3 sigma<br>(whichever is lower) |
| Note: Sigma in this case is the process standard deviation, not the sample. | | |

b. A process with a $C_{pk}$ lower than 1.0 is considered not capable and something needs to be done such as centering the process, decreasing its variation, etc.

7. *Reliability and validity:*

a. Since good quality management depends on data-based decision-making, it is important that the data is both reliable and valid (see Figure 2 in Appendix H).

b. Data is reliable (or "precise") if taking the same measurement gives the same results. Data from a reliable measurement device will have minimal spread.

c. Data is valid (or "accurate") if it is close to the real value being measured. In this other words the inherent bias of the measurement device is not significant.

d. Face, criterion, construct, and content are other concepts related to whether a measurement instrument—such as a test or survey—is valid.

e. It is important for the organization to establish and maintain a disciplined system for ensuring its gages are in good condition (i.e., calibrated) and that only such gages are used.

8. *Qualitative assessment:*
   a. Some aspects of quality cannot be measured quantitatively; e.g., how a customer or employee feels about something, or how the organization's customers are being treated. In these cases qualitative assessments are required.
   b. Some qualitative assessment methods are: survey questionnaires, interviews, observation of behavior (e.g., mystery shoppers), and content analysis (e.g., of normal business processes).
9. *Survey analysis and use:*
   a. Although requiring a lot of time/resources to do well, surveys can provide valuable information to support continuous improvement.
   b. Once the survey is completed, these are the actions recommended by Westcott:
      - Analyze the data including determining such things as the average, range, and standard deviation for each question and any differences due to demographics or other pertinent groups.
      - Compare the data with other information such as from previous surveys.
      - Communicate the information to decision makers and others within the organization that could benefit from it.
      - Use the information to initiate continuous improvement actions when such is indicated.

## V. Customer-Focused Organizations

A. *Customer Identification and Segmentation* (V. Customer-Focused Organizations)

1. According to Westcott, "most quality professionals consider the customer to be any individual or group that receives *and must be satisfied* with the service, work product, or output of a process" (p. 450, emphasis added).
2. To be sure all "customer" requirements are met all possible customers—primary, secondary, indirect, external, consumer/end user, etc.—need to be identified.

1. *Internal customers:*
   a. An organization needs to identify its internal customers and be sure all service/product requirements are being met for each. If any requirements are not being met, appropriate improvements to the applicable processes should be undertaken.
   b. By stating specific internal customer requirements and associated measurements, a quality-level agreement (QLA) eliminates confusion about those requirements and establishes a basis for reviewing provider performance and, as needed, continuous improvement actions. A QLA is like a contract between the provider and the internal customer.
   c. It is important that all internal customer requirements are consistent with

those of the external customers.

   d. It is important that a truly supportive environment is created within the organization, one that emphasizes and makes possible a high level of both internal and external customer satisfaction.

2. *External customers:*

   a. There are many types of external customers—wholesalers, retailers, volume buyers, service providers, etc.—each with its own set of requirements influencing the supplier. Westcott discusses several types on pp. 458/60.

   b. To be sure the organization's set of external customers matches its strategic objectives:

   • Determine the segments presently being served and, if needed, plan any changes to the mix to better support the strategic objectives.

   • Based on the first step identify the requirements of the key segments and determine if any internal processes need to change to fully meet those requirements.

   • Conduct feasibility and risk analyses for the proposed changes and implement those feasible.

   • On a limited basis, try out the changes, make any modifications necessary and then fully implement them.

   • Do a follow-up evaluation of the changes and repeat this set of steps.

3. *Segmentation:*

   a. Instead of trying to satisfy the wants/needs of all possible customers an organization should determine which customer segments are the most important to its strategy/profitability.

   b. A customer (market) segment is a group of customers identifiable by one or more differentiating factors; e.g., purchase volume, type of purchases, geographic, demographic, language spoken, etc. Westcott discusses several segment types on pp. 463/4.

   c. Some ways customers might be segmented are either on the basis of some objective criterion such as age or income or on the basis of customer product/service preferences. Regarding the latter, for example, it might be found that the customer base breaks up into definite clusters in terms of price/quality; i.e., a cluster willing to accept lower quality for a lower price, etc. Or maybe the customer will accept a limited selection of products for a lower price.

   d. It may be useful to refine the segmentation by using two or more criterion such as both age and income.

   e. Some tools to aid segmentation include cluster analysis, factor analysis, geographic information systems (GIS)*, and data mining.

   *Per Westcott's glossary GIS is: A computer-based method of collecting and displaying data in relation to a specific point or location on earth to which each datum is related—the computer program maps the data.

  f. Some recommendations for developing a segmentation strategy:
  - Create and maintain a customer database that includes as much information as possible on customer wants/needs. Use market research and such things as product registrations to help build up the database.
  - Use information from a SWOT analysis to shape the segmentation strategy so that it will take advantage of the organization's strengths and not demand so much in those areas of weakness.
  - Be sure the segmentation strategy fits the organization's overall business strategy so it will indeed support it by guiding the marketing planning and quality improvement initiatives.
  - Build appropriate metrics into the segmentation strategy to both classify customers into segments and evaluate each segment's value to the organization.

**B. *Customer Relationship Management*** (V. Customer-Focused Organizations)

> 1. Customer relationship management (CRM) "aims to learn, in depth, about the customers' needs, values, and behaviors" (p. 471).
> 2. Given the amount of information now available on companies, products, service, etc. and the many choices available, it is becoming harder and harder to win loyal customers.

1. *Customer needs:*
  a. There are many sources of data to help an organization anticipate and understand customer needs; for example, market research, customer complaints, service records, satisfaction surveys, and information from trade journals.
  b. One simple but effective way to assess the value of a product/service to the customer is a priority matrix. For each product/service offered and type of customer set up a spreadsheet listing all the significant features of that product/service. Then for each feature estimate and comment on the extent it either is or isn't likely to satisfy the customer. Finally comment on what action, if any, should be taken to change the feature.
  c. A much more detailed way to look at customer wants (requirements) and to compare them with the organization's response is quality function deployment (QFD). Figure 3 in Appendix H shows a simplified schematic of a QFD matrix. A much more complete and realistic example is shown on p. 477. In essence the QFD matrix matches up customer needs with the organization's production processes to see how well those processes are meeting the needs. The matrix also permits a look at how the organization stacks up against its competitors in meeting those needs.
  d. Other ways to learn of customer needs/wants include: focus groups, surveys, via the Internet, customer advisory boards (usually made up of the best/largest customers), and Westcott's listening post process.

e. The steps in the listening post process are: listen–capture–analyze–learn–improve (LCALI). The basic idea is to train the organization's personnel to constantly be listening for any comments that might give a clue to how it is doing in serving its customers; for example, a casual comment made by a customer on poor or exceptional service or about something in the product they don't like. The process includes a systematic way to capture, analyze, learn from, and use such information for improving customer service or giving recognition for a job well done. Appendix I is an example of a very good way to capture such comments for further processing.

2. *Customer satisfaction and loyalty:*

a. There are many reasons for obtaining customer satisfaction data; e.g., to identify problems, to measure performance, to aid new product development, to adjust strategic plans, goals, and objectives, etc. The ultimate reason is to improve customer satisfaction.

b. A good customer satisfaction system has formal processes for gathering, analyzing, maintaining, and effectively using customer data to improve satisfaction.

c. One way to think about the factors affecting customer satisfaction is the Kano model (see Figure 1 in Appendix J). The "must be" factors will always cause dissatisfaction if not present. The "one-dimensional" factors are linearly related to satisfaction (for example interest rates on savings). Absence of the "delighters" will not cause dissatisfaction but can have a major impact on satisfaction as their number/amount increase. By the nature of things "delighters" soon move into the "must-be" category.

d. Surveys can provide quantitative or qualitative data on customer satisfaction. When quantitative data is used as a sample it must be taken randomly and the sample size must be large enough if a valid statistical inference is to be drawn about the population as a whole.

e. This chart shows some of the common methods for gathering customer satisfaction data, each with its advantages and disadvantages. For example, the amount and quality (depth) of information from in-person surveys can be much greater than that from other types but in-person surveys are much more costly.

| Surveys: | Mystery shoppers |
|---|---|
| Written/mail | Listening-post |
| Telephone | Data mining |
| Web/e-mail | Product/warranty cards |
| In-person | Call center data (from 800-type calls) |

| Comment card/suggestion boxes | Customer databases |
|---|---|
| Observations (of customer behavior) | Data from complaint system |

f. When seeking customer satisfaction data the organization should think in terms of how the customer views value. Figure 2 in Appendix J shows examples from Westcott of product and service characteristics that typically represent value to the customer.

g. Once collected, the organization should have a well defined process for integrating, analyzing, and using customer satisfaction data to carry out corrective/preventive (improvement) actions.

h. There are many potential problems associated with gathering and using customer satisfaction data. For example: poorly designed survey questions, nonrepresentative samples, survey questions asked for no specific reason, and failure to effectively use the data for product/service improvements.

i. Ideally an organization's customers are loyal, "committed advocates" who are so delighted with its products/service they tell others. To make such a reality, customer satisfaction needs to be the focus of every person in the organization along with supporting plans, processes, and practices.

j. Organizations should strive to understand what specifically represents value to its customers. One approach is to use the customer satisfaction data to create a customer's perceived value matrix (CPVM) showing which product/service characteristics are most important to the customer. Assigning a weight to each characteristic will help the organization to know how best to apply its improvement resources. Again, see Figure 2, Appendix J.

3. *Basic customer service principles:*

   a. Westcott list the following ten steps (here summarized) for creating a customer-focused organization (pp. 498/9):

| 1 | Top management personally champions outstanding customer service. |
|---|---|
| 2 | The vision/mission statement clearly states the importance of customers to the organization. |
| 3 | The strategic plans/goals/objectives support and reinforce the vision/mission statement regarding the importance of the customer. |
| 4 | Actions supporting the achievement of customer-related strategic goals are measured and continually improved. |
| 5 | Internal customers receive good service from the internal providers. |
| 6 | Management seeks to empower employees with effective support so they can better serve the customer. |

| 7 | Effective means for obtaining and using customer feedback are maintained. Complaints are especially welcomed and quickly acted upon. |
| 8 | Employees are continually educated in how to give superior customer service. |
| 9 | Benchmarking is used to study and learn from other organizations that provide world-class service. |
| 10 | Ultimately the organization adopts an unconditional guarantee policy. |

b. When the organization does have a complaint it should (1) sincerely apologize, (2) restate the complaint for understanding, (3) sincerely empathize with the customer, (4) take immediate action to resolve the problem, and (5) check back later to be sure the customer is satisfied.

c. One key to customer satisfaction is having well-trained customer service representatives who are knowledgeable about the product/service and how to treat the customer.

4. *Multiple and diverse customer management:*

a. It is important for an organization to understand and be responsive to the special needs of different customers; for example, any special security requirements to protect proprietary information or any special deliver requirements.

b. An organization may conclude it is not worth keeping a customer who is too demanding. However in such a case consideration must be given to the potential damage such a customer could cause by "bad-mouthing" the organization.

c. To the extent possible, those dealing directly with the customer should be given the training and authority to resolve most customer problems immediately.

d. Because of its importance in customer satisfaction, an organization needs to constantly be aware of both its current capacity and the possibility of needing more capacity; the latter perhaps due to adding a new product or a sudden surge in demand. Contingency plans should be developed to cover the possible need for a sudden increase in capacity.

# VI.  Supply Chain Management

## VI.  *Supply Chain management*

> 1. Because much of what is purchased from a supplier becomes a part of an organization's product (or service), it is important to have good supplier management processes.
> 2. It is usually better to work closely with fewer suppliers on a long-term basis than having multiple suppliers who are played off against each other for the sake of a lower price.
> 3. The total cost of supplies is more than just the purchase price since it also involves such things as supplier reliability, transaction costs, how well problems are resolved, etc. This is another reason to have good customer-supplier relations.

1. *Supplier selection:*
   a. If the supplies are standard items such as office supplies, any reputable supplier will do. However in most cases it is necessary to first develop supplier selection criteria for the product/service desired and this should be done using a cross-functional team.
   b. The suppler selection criteria will typically include such things as the supplier's experience/past performance, level of quality management, ability to deliver on time, financial stability, environmental friendliness, technical support ability, and potential for working together with the organization to improve the supplied product or service.
   c. Several methods can be used to see how well each candidate meets the selection criteria including a formal quote, site visits, evaluation of samples, and discussions with other customers.
   d. The result of a supplier selection process is usually a contract spelling out exactly what is to be supplied and other terms of the transaction such as price, delivery, and quality requirements.
   e. A supplier rating system may be appropriate and can range from a very simple measure of quality to a comprehensive system that measures many factors (such as quality, delivery, price, service, etc.). The key question to ask is do the benefits significantly outweigh the costs of setting up and maintaining the system.
   f. The supplier must be involved and agree with the design of the supplier rating system including metrics to be used and the level(s) of acceptable performance.
2. *Supplier communications:*
   a. To minimize the chance for misunderstanding, the organization's requirements must be clearly spelled out in writing to the supplier. These are only some of the requirements that typically need to be spelled out (Westcott, p. 515):

| | |
|---|---|
| quote requirements | order requirements |
| product technical requirements | corrective action requirements |
| process requirements | safety requirements |
| product verification requirements | security requirements |
| product traceability requirements | environmental requirements |
| quality mgt system requirements | financial stability requirements |
| delivery requirements | ethical requirements |

    b. Each requirement could involve considerable detail; e.g., the delivery requirement could include specifying of how the product/material is to be protected during shipment and even the type of transportation to be used.

    c. There are many ways of communicating with suppliers including contracts, specifications, provision of a sample, visits by the supplier to the customer and vice versa, and regular supplier-customer meetings.

3. *Supplier performance:*

    a. It is important for the organization to provide their suppliers feedback on performance. To do this the organization must have a system for collecting, analyzing, and reporting supplier performance data.

    b. Typical performance areas of interest include information on the supplier's quality management system (perhaps collected via survey or an on-site audit), product quality including data on the supplier's processes (e.g., $C_{pk}$) and number of defects, delivery performance, responsiveness to corrective action requests, and progress on reducing costs.

    c. There are many metrics an organization can use for tracking supplier performance such as the number of defects, order processing accuracy, delivery timeliness, responsiveness to problems, and process stability/capability. Each metric must be based on a definite purpose for its use and a determination that it will be worth the cost to set up and measure.

    d. The information gained from the metrics needs to be consolidated into an easy to understand report showing how well the supplier's performance is rated on factors considered important to the organization. Appendix K shows an example of such a report. Note acceptable performance levels are indicated along with how the supplier has performed over the past three quarters.

    e. One important aspect of customer-supplier relations is what action the customer should take when a nonconformance occurs. This is something that should probably be clearly spelled out in the initial contract/agreement.

4. *Supplier improvement:*

There are a number of ways the organization (customer) can help the supplier improve; for example through joint corrective and preventive action efforts, by assessing and recommending changes to the supplier's quality management

system, by providing technical assistance to improve the product and/or production process, and by training supplier personnel.

5. *Supplier certification, partnerships, and alliances:*

   a. A certified supplier is one the organization can trust to consistently deliver conforming product/service so that there is little (if any) need to verify its quality.

   b. Once the organization determines which suppliers are to be certified, the certification criteria and process are developed and used to evaluate the selected suppliers. In general the assessment methods already discussed in sections VI.1 and VI.3 apply to the certification process.

   c. The certification process should also define how performance will be monitored to ensure the supplier continues to meet the certification criteria.

   d. Whereas an alliance usually means simply working together, a partnership is a more formal arrangement "implying a shared fate, mutual benefits, and equal relationships. …and can involve technology, licenses, or supply/marketing agreements" (p. 524).

   e. Some reasons an organization might want to enter into a partnership with one of its suppliers are: to outsource part of its production process when it makes economic sense, to gain the synergies that result by combining resources, to facilitate a breakthrough in technology or the development of a new product/service, and/or to enable it to more easily enter a new market.

   f. Some ways two organizations might work together in an alliance or partnership are: designing and marketing a new product/service, having similar long-term strategies, communication of demand and resource planning information well beyond the normal short-term period, lending of employees, and sharing in profits resulting from the arrangement.

   g. Key aspects of a successful alliance/partnership are: working for mutual benefit (win-win), continually working to build mutual trust, open/complete communications, and using their "interdependence" to advantage (e.g., by helping each other out whenever possible).

6. *Supplier logistics:*

   a. Supplier logistics is mainly about the interface between the organization and the supplier and depends on when and how much of the supplies are needed taking into account the costs of transportation, receiving, and storage. Here are some possible (good) interfaces:

      · If the supplier meets certain standards (e.g., through certification) the supplies are shipped directly to stock, no incoming inspection is required.

      · Given a level demand, a certified supplier, and appropriate transportation arrangements, certain supplies are scheduled to arrive just-in-time at their point of usage.

      · As a further refinement of the last way, the organization works out an

arrangement with the supplier to do part of the final assembly in the form of modules which are then shipped just-in-time for use.

b. Although difficult, good supply chain management ensures all the organizations in the supply chain work together so "the right product or service, in the right quantity, of the right quality, gets to the customer at the right time" (p. 529).

c. The use of information technology is important for coordinating the activities of all parties in the supply chain.

d. It is essential that a decision be made early on which organization and person will be responsible for management of the supply chain.

# VII. Training and Development

VII. *Training and Development*

> 1. It is important to distinguish between education and training. Education means gaining knowledge and training means gaining a skill or set of skills. Education usually involves not only learning facts but also how to think. As an example, the refresher course in this body of knowledge deals with both the acquisition of knowledge and effective ways of thinking to improve an organization's quality. An example of training would be learning how to make a proper rivet on an aircraft—a narrow (but important) skill.
>
> 2. Due to the rapid change in technology and competition it has become important for organizations to continually renew the knowledge and skills of their people—that is, truly become a learning organization.

1. *Training plans:*

   a. Training plans should be part of the organization's overall strategic planning effort so the actual training directly supports some strategic goal/objective. This means top management must be personally committed to and give high priority to the organization's training efforts.

   b. An example of how training might support a strategic goal of improving customer satisfaction would be using it to improve customer relations by training front-line personnel on how to show more genuine concern for the customer.

   c. As with any other improvement initiative, training plans should be evaluated on the basis of costs versus benefits. Although costs, such as salaries of trainers and other associated costs, are relatively easy to determine, benefits, such as improved customer satisfaction or reduced scrap/rework, usually require the organization's best estimate based on prior experience.

   d. The first question to ask when addressing a performance problem is: "Is training the answer?" In fact an employee's poor performance could be due to a system that makes it impossible for the employee to perform well. In

      that case, of course, the system must be changed.

  e. If training is the answer then a plan is developed just as it would be for any project by identifying the outcomes needed, actions necessary to achieve those outcomes, a proposed budget, how outcomes will be evaluated, etc.

2. *Needs analysis:*

  a. Some things that could trigger a need for training and/or education are: a regulation (e.g., for safety or quality-level reasons), a mandate by management (e.g., to meet a specific strategic goal/objective), or to correct a lack of some specific skill or knowledge that is affecting employee performance.

  b. When the need is not mandated or obvious there are several ways to find areas where training/education might help the organization such as a review of records (e.g., audit reports), focus groups, job/task analyses, and by simply talking with workers and their bosses.

  c. Once the specific need is identified the following are some of the questions that need to be answered:

    1. Is it a knowledge or skill deficiency?

    2. What are the specific deficiencies?

    3. What outcome should be expected?

    4. Who is affected?

    5. Will the training/education be accomplished on-the-job, in the classroom, by individual study, or some combination of these?

    6. What facilities/materials will be needed?

    7. Who will conduct the training/education?

    8. How will accomplishment of the desired outcomes be measured?

3. *Training materials/curriculum development and delivery:*

  a. The training of managers differs from the training of nonmanagement personnel in that managers need to know a broader range of skills that go beyond the "technical" aspects of the function managed; e.g., planning, organizing, staffing, and people/project management skills.

  b. Also, as the level of management goes up the organization, there is more emphasis on knowledge education vs. training in specific skills.

  c. It is up to the quality manager to ensure that the need for training in quality principles and practices at all levels is identified and appropriate training takes place.

  d. When carrying out a training program it is important that those trained understand how it will personally benefit them and such should be made explicit at the outset of the training program.

  e. Training programs should take into account adult learning principles. In general adult learners need to be more involved in the development and implementation of the program so it takes advantage of their experiences and knowledge.

  f. A good training program will have specific learning objectives to measure

how successful the training has been. Each learning objective should state:
(1) the observable action that should result from the training (e.g., correctly
assemble module X), (2) the criterion for measuring the correctness of the
action, and (3) the conditions under which the action will be performed
(e.g., within a certain time or type of environment).

g. A useful guide for developing objectives is Bloom's Taxonomy. See
Anderson, L. W., et al., 2001.

h. A lesson plan specifying what will be covered should be carefully prepared
for each training session. Also the instructor should be so well prepared
that he/she can present the material in a confident and positive way.

i. Although traditional classroom lectures and on-the-job training are the two
usual methods of education/training, there are many other possibilities as
alternatives to, or to supplement, those two:

| | |
|---|---|
| Learner-controlled instruction | Discussion format |
| Experiential training | Coaching |
| Case studies | Workbooks |
| Instructional games/simulations | Role-playing |
| Remote learning* | Distance learning* |
| Computer-based instruction | Job aids |

*Remote learning is by correspondence and distance learning is by
electronic participation in a scheduled class.

j. Some ideas for a good training experience: use examples to illustrate
what's being taught, frequently check for understanding, and provide
"hands-on" opportunities whenever possible.

4. *Training effectiveness and evaluation:*

a. Training can be evaluated at various levels as shown on this chart:

| Level | Description |
|---|---|
| Reaction | The "smile" evaluation—simply asking the participant how he or she felt about the training experience. |
| Learning | Using testing to see if the predetermined training objectives (outcomes) were met. |
| Behavior | Determining if the desired behavior changes are actually applied back in the workplace. |
| Results | Was there a net positive gain for the organization due to the training? For example has the scrap rate been reduced in that part of the organization where training took place. |

| | |
|---|---|
| ROTI | Return on Training Investment—similar to "results" but placing a dollar value on the costs of the training and the resultant gains in quality. |

b. There are many reasons why a training program might fail such as an inadequate needs analysis resulting in training the wrong people, failing to adequately show the connection between the training and the strategic objectives and/or the specific job involved, poorly trained trainers, lack of involvement by the line managers, and simply a cultural bias within the organization against training.

c. Ongoing training needs to be continuously evaluated during the planning and delivery stages and after it has taken place. For example, during planning have all possible alternatives for accomplishing the training objectives been considered? During delivery what parts of the program are working and what parts aren't? And why aren't they working so adjustments can be made.

d. After the training were all concerned satisfied? If not, why? Also were the training objectives met? If not why? And how can the training program be improved?

e. The best way to reinforce training is by management and first-line supervisors praising work well done when it is the result of a training experience.

f. Although individual development through the acquiring of knowledge, skills, experience, and "wisdom" is ultimately each person's responsibility, the organization can play an important supportive role. As mentioned above, Appendix C shows this mutual investment in an individual's development.

## References

Anderson, L. W., et al. (Eds.) (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Boston: Addison Wesley Longman, Inc.

Austenfeld, R. B., Jr. (2008, February). The Quality Manager Body of Knowledge (Part 2). *Papers of the Research Society of Commerce and Economics–Hiroshima Shudo University*, pp. 25–94.

Austenfeld, R. B., Jr. (2007, September). The Quality Manager Body of Knowledge (Part 1). *Papers of the Research Society of Commerce and Economics–Hiroshima Shudo University*, pp. 51–105.

Goldratt, E. M., & Cox, J. (2004). *The Goal: A Process of Ongoing Improvement* (3rd rev ed/20th anniversary ed). Great Barrington, MA: North River Press.

Westcott, R. T. (Ed.) (2006). *The Certified Manager of Quality/Organizational Excellence Handbook* (3rd ed.). Milwaukee, Wisconsin: ASQ Quality Press.

# Appendix A

# KESAA Example

(From Westcott, 2006, p. 69)

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**Project Staffing—KESAA Requisites Aanalysis**

[Define KESAA factors for each key project participant planned on the resource requirements matrix—personnel]

Task/work package name: Train project managers in using new Microsoft Project software
Task/WP number: 3.10.01.01
Job/position category/title: Application software specialist

| | |
|---|---|
| Knowledge | • Knows proven techniques for designing and delivering software training to people with diverse knowledge, experience, and skills<br>• Extensive knowledge of project planning and management techniques, tools, and practices<br>• Received Microsoft certificate for completing the advanced MS Project five-day training program within last four years<br>• Earned college degree (software major) |
| Experience | • Has instructed project teams in use of MS Project at a previous employer, two or more times<br>• Used MS Project on two or more previous large-scale projects<br>• Has demonstrated proficiency in providing software technical support for MS Project users working on large-scale projects<br>• Has demonstrated proficiency in using thorough, rapid, and user-friendly techniques for training new software users |
| Skills | • Possesses excellent communication skills (reading comprehension, instructing, technical writing, and listening)<br>• Proficient in using all Microsoft Office software<br>• Trained in using proven instructional technology in training design, delivery, and evaluation |
| Aptitude | • Has capability to adapt the MS Project training to the special needs of each participant<br>• Has worked well in a team environment that is subject to frequent changes. Fast learner. |
| Attitude | • Enjoys imparting his/her knowledge and skills to new software users<br>• Measures his/her success on the improved performance of those trained by him/her<br>• Believes that MS Project is the best selection of project management software, at this time and place<br>• Exhibits "What can we do to make this happen?" demeanor |

Additional comments:

_____
_____
_____
_____

Prepared by:   Anna Lyst                                    Date: June 30, 2004

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# Appendix B

## American Society for Quality (ASQ) Code of Ethics

(http://www.asq.org/about-asq/who-we-are/ethics.html)

**Fundamental Principles**

ASQ requires its members and certification holders to conduct themselves ethically by:

  I. Being honest and impartial in serving the public, their employers, customers, and clients.

  II. Striving to increase the competence and prestige of the quality profession, and

  III. Using their knowledge and skill for the enhancement of human welfare.

Members and certification holders are required to observe the tenets set forth below:

**Relations With the Public**

Article 1 – Hold paramount the safety, health, and welfare of the public in the performance of their professional duties.

**Relations With Employers and Clients**

Article 2 – Perform services only in their areas of competence.

Article 3 – Continue their professional development throughout their careers and provide opportunities for the professional and ethical development of others.

Article 4 – Act in a professional manner in dealings with ASQ staff and each employer, customer or client.

Article 5 – Act as faithful agents or trustees and avoid conflict of interest and the appearance of conflicts of interest.
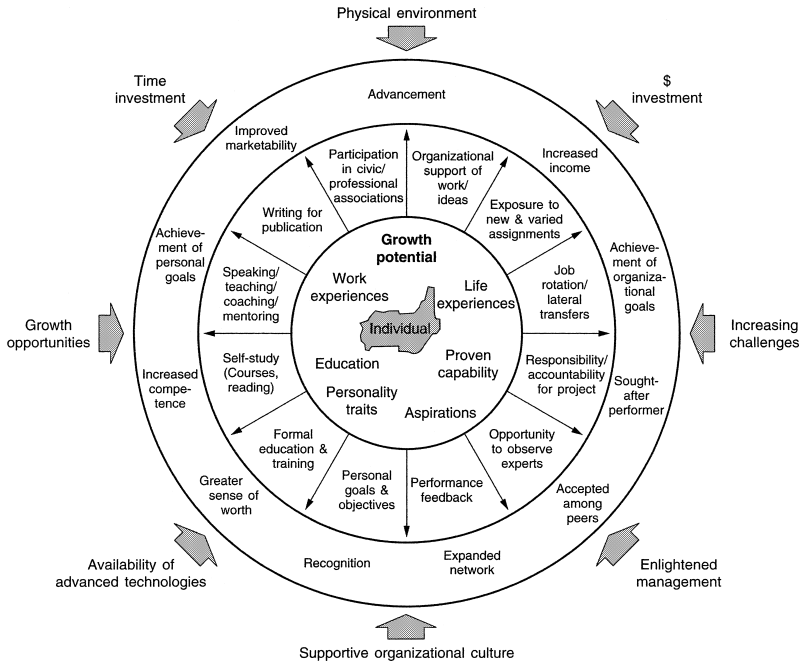
**Relations With Peers**

Article 6 – Build their professional reputation on the merit of their services and not compete unfairly with others.

Article 7 – Assure that credit for the work of others is given to those to whom it is due.

# Appendix C

## The Many Factors That Go Into the Mutual Development of an Employee

(From Westcott, 2006, p. 175)

## **Appendix D** (page 1 of 2)

## **Baldrige Criteria for Performance Excellence Framework**

(http://www.quality.nist.gov/PDF_files/2008_Business_Nonprofit_Criteria.pdf)

The Core Values and Concepts are embodied in seven Categories, as shown in this figure:



The figure above provides the framework connecting and integrating the Categories. From top to bottom, the framework has the following basic elements.

**Organizational Profile**
Your Organizational Profile (top of figure) sets the context for the way your organization operates. Your environment, key working relationships, and strategic challenges and advantages serve as an overarching guide for your organizational performance management system.

**System Operations**
The system operations are composed of the six Baldrige Categories in the center of the figure that define your operations and the results you achieve.

*Leadership* (Category 1), *Strategic Planning* (Category 2), and *Customer and Market Focus* (Category 3) represent the leadership triad. These Categories are placed together to emphasize the importance of a leadership focus on strategy and customers. Senior leaders set your organizational direction and seek future opportunities for your organization.

*Workforce Focus* (Category 5), *Process Management* (Category 6), and *Results* (Category 7) represent the results triad. Your organization's workforce and key processes accomplish the work of the organization that yields your overall performance results. All actions point toward Results—a composite of product and service, customer and market, financial, and

**Appendix D** (page 2 of 2)

## Baldrige Criteria for Performance Excellence Framework
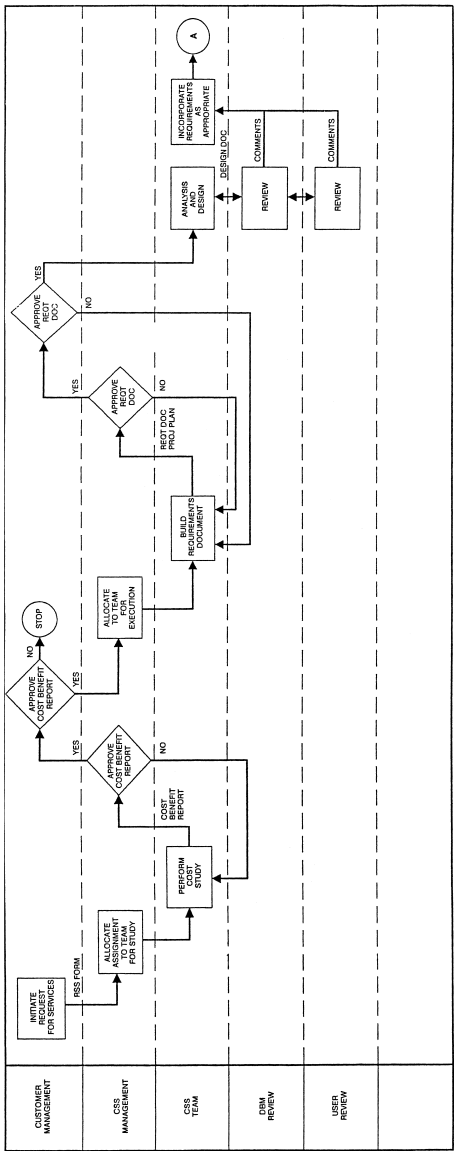### (continued)

internal operational performance results, including workforce, leadership, governance, and social responsibility results. The horizontal arrow in the center of the framework links the leadership triad to the results triad, a linkage critical to organizational success. Furthermore, the arrow indicates the central relationship between *Leadership* (Category 1) and *Results* (Category 7). The two-headed arrows indicate the importance of feedback in an effective performance management system.

**System Foundation**
*Measurement, Analysis, and Knowledge Management* (Category 4) are critical to the effective management of your organization and to a fact-based, knowledge-driven system for improving performance and competitiveness. Measurement, analysis, and knowledge management serve as a foundation for the performance management system.
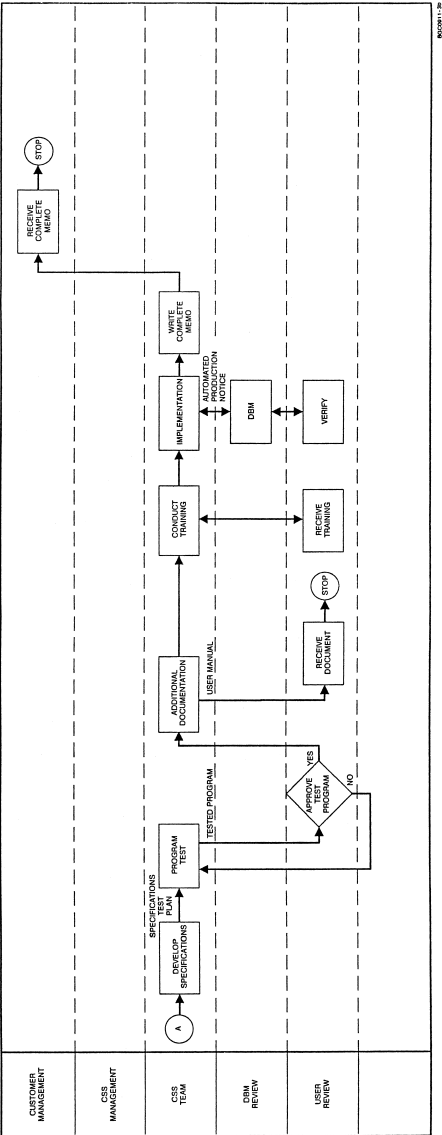
## Appendix E (page 1 of 2)

## Flowchart/Process Map Example

# Appendix E (page 2 of 2)

## Flowchart/Process Map Example (continued)

# Appendix F

# Priorities Matrix Example

(From Westcott, 2006, p. 342, Figures 13.13a/b/c)

|  | Handling | Acceleration | Comfort | Price | Row Total | Row % |
|---|---|---|---|---|---|---|
| Handling |  | 1 | 10 | 5 | 16.0 | 42.3 |
| Acceleration | 1 |  | 10 | 5 | 16.0 | 42.3 |
| Comfort | 1/10 | 1/10 |  | 1/5 | .4 | 1.1 |
| Price | 1/5 | 1/5 | 5 |  | 5.4 | 14.3 |

| | |
|---|---|
| 10 | Overwhelmingly more important |
| 5 | More important |
| 1 | Equal |
| 1/5 | Less important |
| 1/10 | Overwhelmingly less important |

Total     37.8

**Figure A**

|  | Auto 1 | Auto 2 | Auto 3 | Auto 4 | Row Total | Row % |
|---|---|---|---|---|---|---|
| Auto 1 |  | 5 | 1/10 | 1/10 | 5.2 | 10.2 |
| Auto 2 | 1/5 |  | 1/5 | 1/10 | .5 | 1.0 |
| Auto 3 | 10 | 5 |  | 1/10 | 15.1 | 29.7 |
| Auto 4 | 10 | 10 | 10 |  | 30 | 59.1 |

| | |
|---|---|
| 10 | Overwhelmingly better |
| 5 | Somewhat better |
| 1 | Same |
| 1/5 | Somewhat less good |
| 1/10 | Overwhelmingly less good |

Total     50.8

**Figure B**

|  | Handling | Acceleration | Comfort | Price | Row Total | Row % |
|---|---|---|---|---|---|---|
| Auto 1 | (Criteria row total × option row total) | (42.3 × 10.2) 431 |  |  |  |  |
| Auto 2 |  | (42.3 × 1.0) 42 |  |  |  |  |
| Auto 3 |  | (42.3 × 29.7) 1256 |  |  |  |  |
| Auto 4 |  | (42.3 × 59.1) 2500 |  |  |  |  |

**Figure C**

Explanation: In Figure A each criteria to be used is weighted according to its perceived importance relative to each of the other criteria. Figure B is an example of how well each possible choice stacks up against one of the criteria (acceleration)—this is done for each of the other three criteria also (handling, comfort, and price). In Figure C the results of the relative importance of each criteria as shown in Figure A are combined with the "objectively" determined degree to which each of the possible choices (autos 1–4) meets each criteria (Figure B for acceleration). This give a final Row Total/% for each possible choice and the highest value is theoretically the best choice.
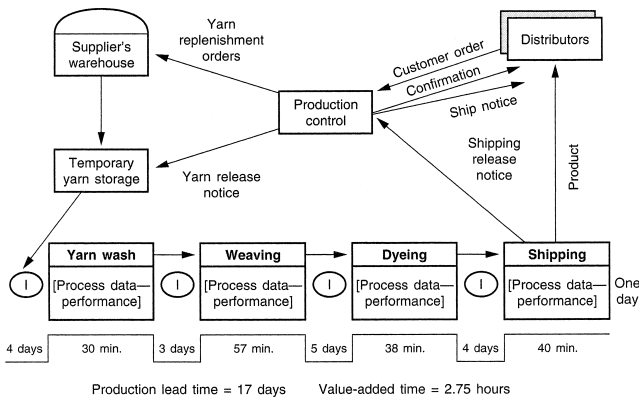
## Appendix G
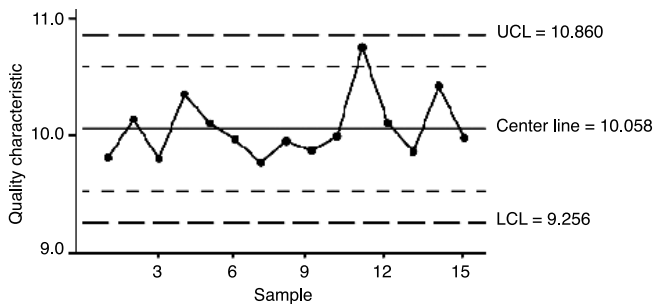


**Figure 1.**  Example of a control chart
(Wikipedia: http://en.wikipedia.org/wiki/Control_ chart).

| Eagle Description | Would Equate To |
|---|---|
| Sharp eyes | Seeing ways to reduce the time required to weed |
| Weightless | Wouldn't be tired after weeding |
| Automatic, air does the work | Very easy to use, doesn't require bending/stooping |
| Wide view | Can cover a lot of ground |
| Kills rodents | Gets weeds out by the roots so they don't come back |

**Figure 2.** Example of using an analogy (Figure 13.22 in Westcott, p. 360).



**Figure 3.** Example of a value-stream map (Figure 14.10 in Westcott, p. 391).

## Appendix H
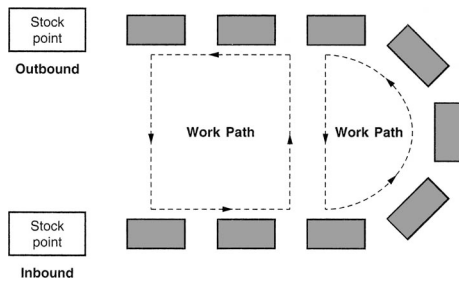


**Figure 1.** Example of a U-shaped cell layout (Figure 14.12 in Westcott, p. 403).
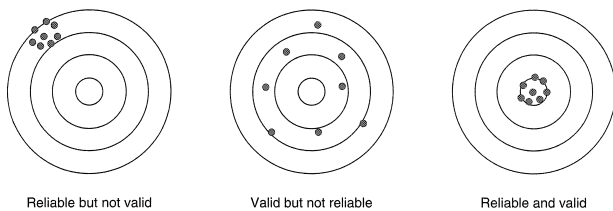


**Figure 2.** Example of reliability and validity (Figure 15.6 in Westcott, p. 442).
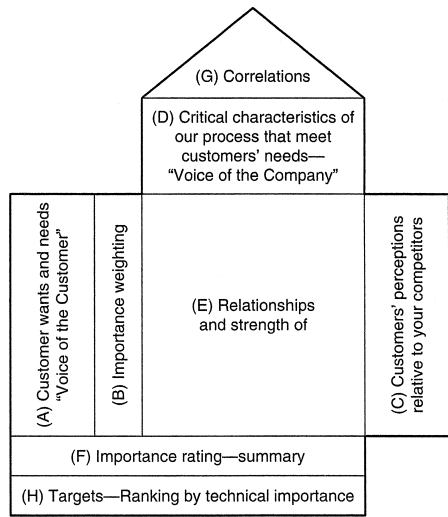


**Figure 3.** A schematic representation of a QFD matrix (also known as the house of qual-
ity) (Figure 17.1 in Westcott, p. 475).

# Appendix I

# Customer/Client Contact Record Example

(From Westcott, 2006, p. 482, Figure 17.4)

---

**Customer/Client Contact Record (CCR)** [CCR no.]

**A. Identification** [Cust./client no.]

| | | |
|---|---|---|
| Contact from: | *[Person's name]* | *[Title]* |
| | *[Location]* | *[Phone]* |
| | *[Customer/client's name]* | *[Fax]* |
| | *[Address]* | *[E-mail]* |
| | *[City]* | *[State/province]* | *[Country]* |
| | | |
| Field listener: | *[Name]* | *[Position]* |
| | *[Dept./location]* | *[Mail stop]* | *[Phone]* |
| | *[Supervisor's name]* | *[Title]* |

**B. Context/situation/place of contact**

❏ Complaint  ❏ Compliment  ❏ General observation *[What?]*
❏ Letter: *[Date]*  ❏ Phone call: *[Date]*  ❏ Face-to-face: *[Date]*  ❏ Other: *[Date]*
*[Describe context in greater detail if "other" is checked:]*

**C. Quote or best recollection of words from customer/client and nature of the contact**

❏ Related to specific order/product:  *[Order no.]*  *[Date]*  *[Product]*
❏ Related to specific representative of this organization:  *[Who]*  *[Date]*
*[Record words used by customer/client's contact. If a direct quote, use quotation marks.]*

*[Describe any details that will make the understanding of the customer/client's perspective clear to persons reading this CCR. Note if customer/client specifically requested notification of resolution or other feedback. Use back of form if needed.]*

*[Field listener's commentary (viewpoint, opinion, interpretation)]*

**D. Action activity**

Triage: ❏ Action needed now  ❏ Investigate further  ❏ Watch trend
   (Corrective action)   (Preventive action)

| | | | | | |
|---|---|---|---|---|---|
| Action assigned to: | *[Name]* | *[Location]* | *[Phone]* | *[Date]* | |
| Follow-up: | *[How?]* | *[Date]* | *[Date]* | *[Date]* | *[Date]* |
| Status reports: | *[How?]* | *[Date]* | *[Date]* | *[Date]* | *[Date]* |

**E. Resolution and Closeout**

*[State how problem/question was resolved:]*  *[By whom]*  *[Date]*
*[Corrective action no.]*  *[Preventive action no.]*  *[Returned material auth. no.]*  *[Other?]*
*[Procedure/work instruction affected]*  *[Date to be changed]*  *[By whom]*
*[Forms/computer programs affected]*  *[Date to be changed]*  *[By whom]*
*[Status/feedback to be provided—how?]*  *[To whom]*  *[By whom]*  *[By date]*
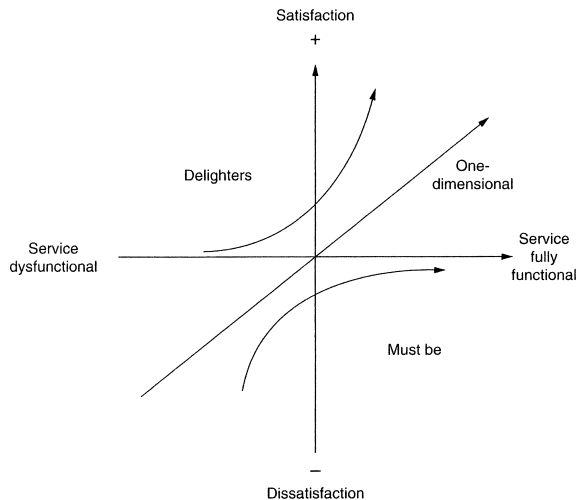*[Closeout code]*  *[Closed by:—print]*  *[Signature]*  *[Date]*

---

# Appendix J

Satisfaction
+

Delighters

One-
dimensional

Service
dysfunctional

Service
fully
functional

Must be

−
Dissatisfaction

**Figure 1.** The Kano model (Figure 17.6 in Westcott, p. 485).

| **Characteristics—Product** (examples) | Performance | Serviceability |
| --- | --- | --- |
| | Reasonable price | Ease/flexibility of use |
| | Durability | Simplicity of design, aesthetics |
| | Safety | Ease of disposal |
| **Characteristics—Service** (examples) | Responsiveness | Credibility/image |
| | Reliability | Confidentiality/security |
| | Competence | Understanding the customer |
| | Access | Accuracy/completeness |
| | Courtesy | Timeliness |
| | Communication (sensitivity, genuine interest/concern) | |

**Figure 2.** What customers value (Table 17.1 in Westcott, p. 491).

# Appendix K

# Supplier Performance Report Example

(From Westcott, 2006, p. 519, Figure 18.1)

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**ABC Company**
**Supplier Performance Report for:**

**Fourth Quarter 2000**

Supplier: XYZ Company, Anywhere U.S.

| Category | Possible Score | Actual Score |
|---|---|---|
| Product quality | 30 | 25 |
| Delivery | 30 | 30 |
| Quality system | 20 | 15 |
| Corrective action | 20 | 20 |
| | **100** | **90** |

| Performance for past three quarters: | 80, 80, 85 |
|---|---|
| Average score of all suppliers: | 88 |
| Performance of best supplier: | 95 |

Performance categories:
| Preferred partner | 95–100 |
|---|---|
| Acceptable | 80–94 |
| Probation | <80 |

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