2

Planning for Quality

OBJECTIVES

1. To emphasize the importance of planning in the quality management system.
2. To compare and contrast formal and informal planning.
3. To provide a systematic approach to planning.

TERMINOLOGY

Formal plan: A written, documented plan developed through an identifiable process.

Functional plans: Plans that originate from the functional areas of an organization, such as production, sales, and personnel.

Goal: (used interchangeably with *objective*) A statement that gives the organization or its departments direction and purpose.

Long-range plans: Plans that pertain to a period of time beyond the current year.

Objective: (used interchangeably with *goal*) A statement that gives the organization or its departments direction and purpose.

Planning: A process of deciding what objectives to pursue in the future and in what order to achieve them.

Policies: Broad guidelines for action which are interrelated with goal attainment.
Procedures: A series of related tasks expressed in chronological order to achieve policies.
Short-range plans: Plans that cover the current year.
Strategic planning: Planning that covers multiple years.
Tactical planning: Planning that presupposes a set of goals handed down from upper management.

INTRODUCTION

Planning is the management function that produces and integrates objectives, strategies, and policies. The planning process answers three basic questions:

1. Where are we now?
2. Where do we want to be?
3. How can we get there from here?

Planning is concerned with future actions and decisions of management. By setting objectives and establishing a course of action, management commits to "making it happen." Planning is the easiest where change happens the least. Planning is the most *useful* where change is the greatest. Most planning is carried out on an informal basis. This occurs when management does not record their thoughts and instead carries them around

TABLE 2.1
Formal versus Informal Planning

Planning	
Formal	**Informal**
Rational	Emotional
Systematic	Disorganized
Reviewed and updated	Sporadic
Used for improvement	Mostly for show
Documented	Memory based

in their heads. Table 2.1 shows the contrast between formal and informal planning.

BUSINESS QUALITY PLANNING

Elements of an Effective Quality System

The quality management system (QMS) assumes that each group performs their intended responsibilities (see Table 2.2). A worst-case scenario would be where executive management performs the role of lower-level management, leaving the company leaderless and dysfunctional.

Marketing

Management should identify the current market position of the company: where is the customer, and how and what do they buy? This would entail the identification of the market scope and depth of the products or services being offered. Additionally, management should be able to discern the market share they hold in contrast to that of their competition. A vital step is to identify current and future customer needs in terms of product features and benefits by surveying the marketplace. This step is critical to the organization's success. The major steps in marketing are as follows:

1. Identify the customer(s). (Market)
2. Identify the customer's product and service needs. (Product features)
3. Identify how much the customer is willing to pay. (Pricing)
4. Identify where the customer goes to buy. (Placement)
5. Identify how the customer hears about companies like yours. (Promotion and sales)

Setting Objectives

Setting objectives requires a cascade approach down through the company hierarchy as follows:

TABLE 2.2

QMS Responsibility Matrix

Level	Organizing	Planning	Control	Staffing	Motivation
Executive (System)	Develops the company organizational structure	Establishes the departmental policies and objectives	Monitors summary reports showing progress toward objectives	Identifies and recruits the management staff for the various departments	Meeting overall company objectives (monthly *effectiveness*) BQR
Management (Process)	Develops departmental groups responsible for specific tasks	Develops group objectives, requirements, and procedures to achieve executive objectives	Reports and monitors group progress (output) toward objectives	Identifies and recruits associates for the various groups capable of achieving objectives	Meeting departmental objectives (weekly *efficiency*) activity report
Associate (Product)	Works within a group established by management	Regulates their tasks to ensure that work is done in a consistent manner	Records data related to the department's output requirements	Collaborates work with others in the group	Ensuring the *accuracy* of the output produced daily (recordkeeping forms)

1. It begins at the top with a clear statement of what you are in business for.
2. Long-range goals are formulated for this statement.
3. The long-range goals provide the bases for short-term objectives (they are linked).
4. Objectives are established at every relevant level and function in the company.
5. This process continues down throughout the entire company.

This goal-setting process does not imply any specific management style. It does ensure that all departments and functions are in step with the major company objectives and that there is no incongruence.

Long- and Short-Range Objectives

Long-range objectives usually extend beyond the current year. These objectives must support the organizational purpose. Short-range objectives should be derived from an analysis of the long-range objectives. The analysis should result in an establishment of priorities that apply at all the various levels in the company and are synchronized with each other and the long-range objectives. The major steps in establishing objectives are as follows:

1. Formulate long-term goals.
2. Develop overall objectives.
3. Establish departmental objectives.
4. Formulate functional quality plans.
5. Establish performance metrics.
6. Implement.
7. Review performance.

After the goals have been established, an action plan for achieving the goals should be developed as follows:

1. Determine major activities needed to meet the objectives.
2. Determine subactivities under the major activities.
3. Assign responsibility for each activity.
4. Identify resources required to meet goals.

TABLE 2.3

Business Quality Plan

1. Categories and Classifications	2. Department	3. Responsibility		4. Tracking	5. Goal or Objective
		Primary	Alternate		
Product or Service					
Customer-related processes	Sales	Tom	Alice	Sales revenue per month (invoicing)	> Last month
Design control	Engineering	Mary	Jim	Project hours and cost	Per project
Purchasing	Production	Sue	Alice	Budget returns and allowances	<= Last month < 2%
Customer-supplied property	Production	Sue	Alice	Inventory	Zero spoilage
Product identification and traceability	Production	Mary	Alice	N/A	N/A
Process control	Production	Mary	Alice	Rates and yields	
Direct cost	Per quote				
Preservation of product	Shipping and receiving	Hal	Sam	Back orders/On-time delivery	<= 5%/95%
Servicing	Quality	Sally	Andy	Time and material	Per quote

The first three steps were identified in the responsibility matrix shown in Table 2.2 under business organization. Establishing and allocating the goals are discussed next.

SETTING BUSINESS METRICS

The process of determining objectives and goals is directly related to the functional categories (see Table 2.2) in the business, starting with the product- or service-producing activities. These activities are critical for the survival of the organization, where nonconformities have an immediate impact on cash flow. Some of these activities are revenue centers, while others are cost centers. The objective should be established to maximize revenue and/or reduce (or control) cost.

In Table 2.3, sales would be a revenue center (*we take money in*), where we would try to establish a realistic maximum goal or objective. Purchasing, on the other hand, is a cost center (*we pay money out*), where we would want to establish a realistic minimum (or control) goal or objective. It is senior management's responsibility to find the optimum balance between revenue, cost, and expected market share while setting objectives. There is always a cost associated with operating a business, and it is unrealistic to assume there isn't. Therefore, fixed costs based upon functional area throughput should always be considered a normal part of the process.

The very nature of the strategy- and goal-setting process is dynamic and interactive. For the most part, we would be tracking actual results and comparing them to the plan (actual/plan) in order to determine our progress and performance. The results of the current goals may change and lead to a revised strategy.

PROCESS QUALITY PLANNING

Each of the classifications or subactivities can be further analyzed and planned for their respective requirements. This is done by identifying the process tasks in chronological order. In short, this is a task listing without any of the detail. Detailing each task or step would require an explanation of how each step is accomplished. However, in process planning we only

TABLE 2.4

Process Quality Plan: General Information

General Information			
No.100	Classification (Process): Sales		Date xx/xx/xxxx
Phase: ☐Design ☐Review ☑Production	Contact Name: PDM		Phone: 999-9999 x999
Department: Sales	Primary: Tom	Alternate: Alice	
Tracking: Sales revenue per month (invoicing)		Goal: > Last month	

need to know what steps or tasks are performed, not the actual "how-to" information. An example of this is shown in Table 2.4.

General Information

Table 2.4 shows the general information section of the process quality plan (PQP). It is derived from the business quality plan shown in Table 2.2. Each process plan is assigned a unique number for cross-reference and identification purposes. Then the classification and process step is identified, along with the effective date of the plan. The planning phase is identified; *design* is where the plan is in the process of development, *review* is when the plan is awaiting approval, and *production* is when the plan is in effect. Additionally, the plan identifies the departmental responsibilities, including performance tracking and goal(s). This last step is important, because this information will be used to update and revise the plan as necessary. It will also be used for the establishment of the performance measurement system and control.

Details

The details of the PQP begin with a simple procedural analysis flowchart (Table 2.5, column 1). Procedural analysis flowcharts are a useful means of making a "step-by-step" analysis of processes. The details of present (or proposed) procedures can be recorded, which will help point out duplications of effort, time delays, excessive inspection, and transportation. Analysis of existing systems can stimulate an analysis of major process changes. Adjacent to each symbol, each task is described with a title (column 2). Next to each description, we would identify any product or process requirement (column 3) as shown in Table 2.5.

TABLE 2.5

Process Quality Planning: Partial Detail

1. Flowchart					2. Process Step Description	3. Requirement (Product or Process)
Operation	Transportation	Inspection	Delay	Storage		
●	○	○	○	○	Select next sales order.	Oldest date
○	○	●	○	○	Check salesperson's math.	Correct price
○	●	○	○	○	Walk to accounts receivable file.	N/A
●	○	○	○	○	Find customer's balance.	Name and account number
●	○	○	○	○	Record customer's balance.	Correct amount

Failure Modes

Since there are no perfect processes, it will be necessary to identify problems early to control or eliminate them from happening. To do this we must determine what possible problems we may encounter during each process step (see Table 2.6). Of course, through our experience or from performing experiments, we can deduce the cause of these problems. Whenever possible, we should design the process in such a way as to reduce or eliminate all possible problems. Realistically, the elimination of all problems is not possible, but we can reduce their impact and have contingencies for their occurrence. This brings up a point: *why do we have problems?* Usually the reason there are problems in a process is because it was designed that way. If the process was put together ad hoc and informally, the output will be erratic. Couple this with inconsistent or poor management leadership, and it is truly amazing that any work gets accomplished.

The planning process provides consistency in purpose and direction of action to the accomplishment of departmental goals. In short, a good quality management system rewards actions, not words. This is the vital

TABLE 2.6

Process Quality Planning: Failure Modes

1. Flowchart					2. Process Step Description	3. Requirement (Product or Process)	4. Possible Problems	5. Possible Causes
Operation	Transportation	Inspection	Delay	Storage				
●	○	○	○	○	Select next sales order.	Oldest date	Orders mixed up	Salesperson rushed
○	○	●	○	○	Check salesperson's math.	Correct price	Wrong amount	Salesperson calculated wrong
○	●	○	○	○	Walk to accounts receivable file.	N/A	N/A	N/A
●	○	○	○	○	Find customer's balance.	Name and account number	File not found	Salesperson failed to identify new customer
●	○	○	○	○	Record customer's balance.	Correct amount	Balance wrong	Calculation incorrect

difference between a professional business manager and a novice. A novice relies upon hearsay, heightens unimportant issues, and makes decisions on gut feelings and emotions. A professional relies on information derived from statistical analysis with regard to the process for which he or she has responsibility. As you can see from Table 2.6, careful consideration is given in the design of a process to make it foolproof against error. If you want to keep problems away, you had better plan.

Control

The final step in process quality planning is to determine the internal controls for process stability. In Chapter 3, we will take an in-depth look at control systems. For our purposes here, we will explore how errors are sensed. In Table 2.7, we begin to describe how deficiencies are detected (call sensors). Errors can be detected directly or indirectly. Those that can be directly sensed are done so by making observations of the object, or error in this case. This can be done visually by looking at it or through a test instrument applied to the object. Test instruments may include rulers, micrometers, calipers,

TABLE 2.7

Process Quality Planning: Control

1. Flowchart					2. Process Step Description	3. Requirement (Product or Process)	4. Possible Problems	5. Possible Causes	6. Sensor	7. Methods		8. Document	9. Reaction Plan
Operation	Transportation	Inspection	Delay	Storage						Sample	Frequency		
●	○	○	○	○	Select next sales order.	Oldest date	Orders mixed up	Salesperson rushed	Visual	1	*	Sales order	Call manager.
○	○	●	○	○	Check salesperson's math.	Correct price	Wrong amount	Salesperson calculated wrong	Calculator	1	*	Sales order	Call manager.
○	●	○	○	○	Walk to accounts receivable file.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
●	○	○	○	○	Find customer's balance.	Name and account number	File not found	Salesperson failed to identify new customer	Visual	1	*	File	Call manager.
●	○	○	○	○	Record customer's balance.	Correct amount	Balance wrong	Calculation incorrect	Calculator	1	*	File	Call manager.

* = All.

gauges, microscopes, viscosity tubes or cups, thermocouples, odometers, and hydrometers, to name a few. All these devices make direct measurements on objects. The measurements can be compared to requirements to determine if the process is operating within defined limits.

Indirect measurements are those which monitor the effect of an object. Test instruments for indirect measurement are multimeters, oscilloscopes, volt meters, amp meters, air speed gauges, gravimetric meters, dosimeters, and spectrum analyzers, to name a few. These devices measure the effects of the objects they measure and the object itself.

In Table 2.7, we describe the measurement method (sensor) along with the sample size and frequency. Both of these are derived statistically. Also included are provisions for the identification of any procedures or records used in the task. Last, when errors do occur, the last column describes what steps to take to remediate the problem.

PROJECT PLANNING

While the process quality plan is established for those activities which are an integral part of the business, there are those times when planning occurs for short-duration processes. When this occurs, we must apply the concepts of *project* planning. A project plan (see Table 2.8) is made up of significant events or milestones that must occur in some time sequence in order for a project to be completed. A project plan is a schedule of tasks over the duration of the project. Project plans are an effective means of depicting a project schedule and reporting progress as it occurs. The type of plan most often used is a Gantt-type chart, as shown in Table 2.8. When viewing this plan, you should remember that the responsible manager should have a list of all the projects under his or her control along with their associated status. In turn, each project on the list is then delegated to a project manager.

General Information

The general information section of the plan again identifies the responsible parties for the project, along with associated departmental responsibility and accountability. This helps ensure organizational integrity, line of communication, and structure.

TABLE 2.8

Project Planning: Gantt Chart

General Information																							
No. 100	Project Name: Demo																				Date 99/99/9999		
Project Manager: PDM																					Phone: 999-9999 x999		
Department: Engineering			Primary: Tom																		Alternate: Alice		
Planned Hours: 100			Actual Hours: 50																		AI: 0.5		
Planned Cost: $3,750			Actual Cost: $1,850																		CI: 0.49		
Start Date: 99/99/9999			Stop Date: 99/99/9999																		Status Date: 99/99/9999		
																					SI:1.02		
1. Activity or Document		**2. % Completed**	**3. Status**	**4. Period Ending (Week)**																			
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**								
Study phase		45	●	■	■	■	■	■	■	■	▒	▒	▒	▒	▒								
Initial market analysis		100	●	■	■	■	■																
Product scope and depth		100	●				■	■	■	■													
Team feasibility report		50	○					■	■	■	▒	▒	▒	▒									
Feature listing		0	○							▒	▒	▒											
Functional requirement		0	○								▒	▒	▒	▒									
Capability report		0	○										▒	▒	▒								

Note: ● = completed, ○ = incomplete,

Status Reporting

The next few blocks on the project plan in Table 2.8 are status blocks, which are used to track the project's progress as well as to record the planned and actual, time and cost. The Achievement Index (AI) is calculated by dividing the actual hours by the planned hours. An AI value of less than 1.00 represents underachievement. Accordingly, the Cost Index (CI) is calculated by dividing the actual cost (time and material) by the planned cost. A CI value greater than 1.00 represents overexpenditure. The overall Status Index (SI) is calculated by dividing the AI by the CI. An SI between .9 and 1.1 is normal; greater 1.3 or less than .7 would require immediate attention.

Detail

In the body of the Gantt chart, the first column is used to identify the tasks to be performed. This may require you to break down a task into constituent parts called *parent-child relationships*. This can be seen in Table 2.8, where the *study phase* task is the parent and the steps below are the children belonging to this task. Adjacent to each step is a reporting column for percentage completed, where we would designate what percentage of the step has been finished. Next to this is a column which provides a graphical status indicator. The plot portion of the chart shows a bar for the duration of the task or step in which black represents completion and gray indicates the scheduled time allotted. The bar turns black as the project progresses based upon the percentage completed. From Table 2.9, you can see that the *feature listing* step has not been started, even though it was scheduled to start in week 7.

PRODUCT QUALITY PLANNING

General Information

At last, we have come to the actual product or service itself. Product quality planning (see Table 2.9) is by no means the last step; in fact, it starts when the product is being designed. This should be part of the design test phase outputs prior to the actual design testing. Typically, this plan is developed conjointly with the product illustrations (e.g., drawings and schematics), bill of materials, and production work order. These plans are utilized in raw

TABLE 2.9

Product Quality Plan

Subject:				Effective Date:	Number: 99999
Part Number: 999-9999 Revision A				Supersedes: 99/99//99	Page: 9 of 9
Approved By: ZZZZZZ					
Instructions: Inspect the product to the characteristics listed below (also see drawing and/or inspection and test work instructions). Use a C = 0 sampling plan with an acceptable quality level of 10 unless otherwise specified below. Record the results of the inspection on the appropriate inspection report or log. In the event of a nonconformity, follow work instructions.					
No.	**Characteristics to Be Measured or Inspected**	**Specification and Tolerance (±)**		**Acceptable Quality Level**	**Inspection or Measuring Equipment or Method**	**Comments**
①	Overall length	12”	.25	1.0	Caliper	
②	Inside diameter hole *A*	.25”	.005		Micrometer	
③	Inside diameter hole *B*	.25”	.005		Micrometer	
④	Hole *A* location	1.5”	.010		Caliper	
⑤	Hole *B* location	2.5”	.010		Caliper	
⑥	Overall width	6”	.250		Caliper	
⑦	Thickness	.250”	.005		Caliper	
⑧	Overall height	3.0”	.025		Caliper	
⑨	Color: tan	—	—		Visual	
⑩						

material, work-in-process components, and finished goods. These plans are used to perform product verification and validation. In some cases, these are called *test plans* or *specifications*. From Table 2.9, you can see there is a general information area called *subject* where part information is entered, as well as room for effective dates and approval and control numbers. Additionally, there is an area for special instructions where necessary.

Detail

In the body of Table 2.9 is a column called *No.*, which is used to count the rows on the form and also serves to reference a characteristic on the

product illustrations (e.g., drawings or schematics). This number can be annotated on the illustration to correspond to the characteristics being specified in the product quality plan. Adjacent to each number is a description of the characteristic to be measured, which can be either a discrete or continuous variable. For continuous characteristics, we need to identify a target value with an upper and lower limit.

There may be occasions where you would need to specify an acceptable quality level (AQL) for a particular characteristic. The term *AQL* refers to the percentage nonconforming and is used for determining an appropriate sample size. Since not all characteristics are created equally, some are more critical than others. Those with lesser criticality may be assigned a higher AQL than those that are more critical.

For each characteristic, we should identify the type of measurement method or equipment to use. This will help inspection and test planning as well as help determine the competency requirements for personnel performing the tests. It also provides congruence with suppliers of raw material with regard to testing methods. Of course, you could also identify a documented test procedure in this column. Last, there is a column for making any additional comments.

PRODUCT VERIFICATION AND VALIDATION PLANNING

Responsibility and Interfaces

Responsibility within the company for the validation planning should be established. As part of validation planning, responsibilities for validation activities and functions for supporting and interfacing departments should be determined. Typically, supporting and interfacing departments include manufacturing, engineering, purchasing, and others. Arrangements for coordination with other validation groups or departments should also be identified.

Information Accessibility

Project information, such as contracts, schedules, work orders, specifications, drawings, manuals, procedures, configuration of operating equipment, and purchase orders, should be available to the personnel who plan

for validation. Requests for quotes and bid proposals may be obtained if they contain information useful to the validation-planning function.

Files and Records

Facilities and files for maintaining forms, including tags, hard copy, and computers, should be available. Capability for obtaining and maintaining relevant specifications, drawings, contracts, and other documents in readily accessible files should be established. Capability for validation records storage and protection for established retention periods and retrieval from files should also be established. Additionally, there should be access to referenced documents such as standards (such as those of the American National Standards Institute [ANSI] or ASTM International [ASTM]) that set forth acceptance criteria, texts on validation sampling, and other pertinent documents, including applicable codes.

Validation Facilities

Facilities and validation equipment required for performing validations should be determined and provided as necessary. Consider some of the following:

1. Space and equipment (surface plates, tools, gauges, etc.) for validation, affording environmental conditions (e.g., appropriate lighting level, temperature and humidity control, and cleanliness level) consistent with handling and validation needs of products and services
2. Facilities for receiving and handling items being validated (shelving, storage areas)
3. Facilities for taking verification samples and for containing test results to validate significant characteristics
4. Facilities for maintenance of archived samples where critical materials are involved
5. Physical validation systems and equipment for performing validation and testing, including dimensional, electrical, mechanical, and pneumatic examination; nondestructive examination (NDE); and destructive examination (DE)
6. Facilities or alternate provisions for calibration of measuring equipment

Validation Personnel

The validation-planning system should consider the availability of product analysts with the capability (education and technical training) to perform the types of validations required. Typically, broad-based capabilities for dimensional, optical, nondestructive, and destructive evaluation and testing provide the greatest versatility.

Validation Procedures

Product analysts should be provided detailed guidelines, checklists, instructions, or procedures when necessary to supplement the drawings, specifications, and other applicable documents.

Scheduling and Revising Validation Plans

The validation-planning process should include a process for determining the need for validation plans and for initiating such plans. These should be developed in conjunction with the manufacturing and construction operation process plans.

POLICIES, PROCEDURES, AND OBJECTIVES

Organizational goals, policies, and procedures are not mutually exclusive components (see Figure 2.1). Each is related to the other; for example, policies relate to objectives, while procedures relate to policies. Similarly, they are an integral part of the organizational structure. Policies identify what departments do, whereas procedures tell us how to do it. Goals are achieved through policies and procedures.

In and of themselves, they can do nothing unless senior management is dedicated to making them happen. There are many cases where companies have failed to follow the correct course of action. This is due in large part to senior management becoming self-focused, where their own well-being and self-interest take priority over those of the organization. Policies, procedures, and goals then become imaginary rather than realistic. Being imaginary, the objectives become negative motivators destroying the creditability of senior management. A lack of integrity leads to a dysfunctional

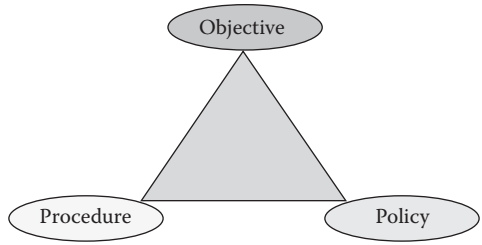


FIGURE 2.1
Interaction of objectives, policy, and procedures.

organization. In fact, any organization that operates on the premise of "What's in it for me?" will find it difficult to achieve true quality results.

Policies

The first step in establishing company policies is to identify the customer, how the customer buys, and how the customer can be reached. Second, top management must determine customer needs. Top management should determine what the present and future business should be. The next step is to establish organizational responsibility, authority, and resources as follows:

1. Determine major activities in the company.
2. Determine subactivities.
3. Assign primary and alternate responsibilities.
4. Identify the resources needed.

Policies exist at all levels of the organization. A typical organization has policies that relate to everyone in the company. Policies outline a general course (or framework) of action to be followed and do not precisely describe how to achieve specific objectives.

A general outline for writing a policy statement is as follows:

1. Describe the major activities and subactivities.
2. Identify the objective.
3. Define the department that is responsible.
4. Identify the associated procedure.
5. State the policy.

In most cases, the policy statements are grouped together into a manual (e.g., a quality policy manual). This manual is typically assigned a control number for reference, and is dated and approved by senior management.

Procedures and Rules

Procedures and rules define in step-by-step fashion the methods through which policies are achieved. They outline the manner in which a recurring activity must be accomplished. Procedures should allow for flexibility and deviation.

Rules require that specific actions be taken with respect to a given situation (step). Rules leave little doubt concerning what is to be done. They permit no flexibility or deviation. Unlike procedures, rules do not necessarily specify a sequence.

A basic outline for a procedure is as follows:

1. No. (control number assigned for reference)
2. From (the person approving the procedure)
3. To (the person responsible for executing the procedure)
4. Date (the date the procedure was approved)
5. Subject (major activity)
6. Regarding (subactivity)
7. CC: (carbon copy list)
8. Procedure steps and rules

Typically a master list is maintained that identifies all the procedures used by the organization along with the approval date.

FORMS AND RECORDS

The task of designing forms for quality is the responsibility of the quality management. The management representative must know (1) what data the user wants to collect, and (2) how the form is going to be used in the quality system.

The basic parts of a form are as follows:

1. Title (identifies the form)

2. Instructions (tells how to complete the form)
3. Heading (contains all the general data)
4. Body (specific data the form is designed to collect)
5. Conclusion (contains approvals, signatures, and summary data)

There are two basic styles of forms: open style and boxed style. The open style is the simplest. It consists of headings and open areas in which data can be collected. The boxed style allocates space to each data item. Each box is clearly identified by name or by a brief description. Forms are seldom purely "open" or purely "boxed." They are usually described as predominantly open or boxed, or as a combination of both. Completed forms are considered records.

Typical control of the forms requires a number to be assigned to the form. This number is usually found in the footer section of the form. A date is commonly found next to this number signifying the date the form was placed into use. These forms are then listed on the document master list. The storage location, filing method, and retention times must be identified for completed forms (or records).

BLUEPRINTS (PRODUCT SPECIFICATIONS)

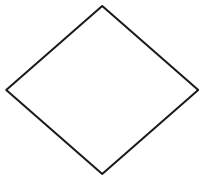
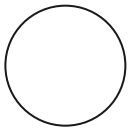
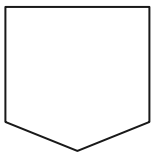
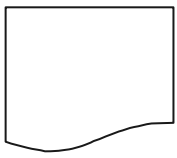
Product specifications developed internally should be identified along with a revision letter code which can be cross-referenced in some manner to a definition of what changed. Normally, there is a list showing the history of revisions for each part. In most cases, these specifications are maintained in a filing system.

PROCESS FLOWCHARTING

Flowcharting is a graphical technique specifically developed for use in computer science. It is a pictorial representation that uses predefined symbols to describe data flow in a business, or the logic of a computer program or process. The symbols shown in Table 2.10 are "predefined"; their shapes identify data and communicate what is happening to the data.

TABLE 2.10

Flowcharting Symbols

Symbol	Description
	*Terminal* symbol indicates the start, stop, halt, pause, or interruption in a process.
	*Process* symbol is a representation of a task performed in the processes.
	*Decision* symbol is used for operations that determine which of two or more alternative paths will be followed in a process.
	*On-page* connector is used to connect or link other flowchart symbols.
	*Off-page* connector is used when the flowchart is continued on another page.
	*Document* symbol is used to describe any input or output that is a paper document.

Flowcharts help quality professionals to describe and communicate complex sets of processes and data in three principle ways:

1. Analyze existing processes.
2. Synthesize new processes.
3. Communicate with others.

Standardization of Symbols

National and international efforts to develop standard symbols began in the early 1960s. The efforts in the United States resulted in the set of symbols adopted by the ANSI. See Table 2.10.

Normal Logic Flow

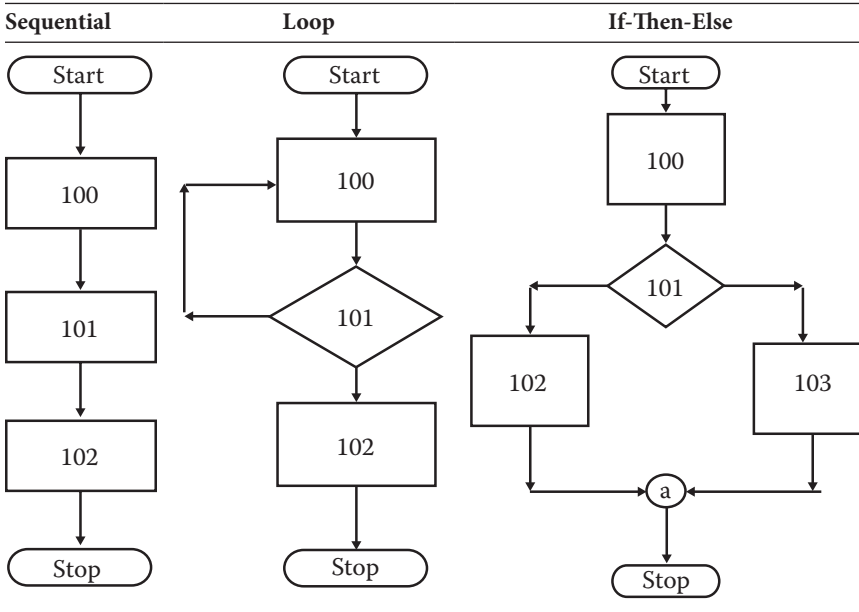
The normal logic flow is downward and by columns from left to right.

Process Flow

As shown in Table 2.11, there are three basic process flows that have been identified in processes: (1) sequential, (2) loop, and (3) if-then-else. These flows appear the most often when one is describing processes. Your process can be a combination of any of these. As you will notice, for the most part each symbol has one input and one output, except in the case of the decision symbol, where there are two outputs (true or false).

TABLE 2.11

Basic Process Flows



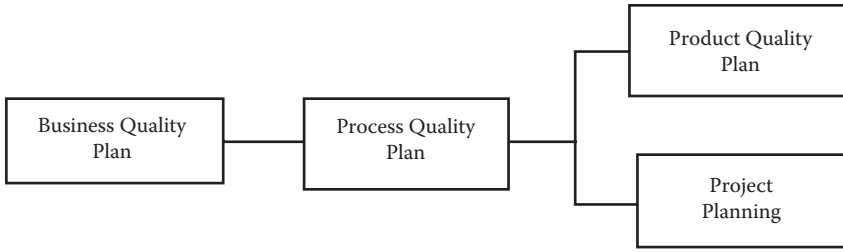


FIGURE 2.2
The quality-planning process.

COMMUNICATION

The business quality plan in Table 2.2 is the first plan to be developed. The process quality plan in Table 2.6 is derived from the business quality plan, ideally for each activity listed. For short-term processes a project plan (Table 2.8) is used, while a product quality plan is made for each type of material used from raw material to finished goods. These plans can then be revised as needed. The axiom "Measure twice and cut once" more than applies when it comes to planning. These plans are communicated from the senior management down throughout the entire organization and provide the basis for meaningful dialogue within the company.

SUMMARY

From Figure 2.2, you can see that the planning process starts with the business quality plan, from which in turn the process quality plans are derived. Additionally, product and project plans are generated based upon the process quality plan. Projects can be in the form of design control for new product development, or the implementation of corrective or preventive actions. The product quality plans define the features, functions, and characteristics of the product and/or its components. These plans are integral to each other and cannot be performed separately. Nor can these plans start with the product and work backward. Doing so would indicate a lack of management commitment and overdelegation.

REVIEW QUESTIONS

1. What is the purpose of organizational planning?
2. Describe the different types of plans.
3. Define the business quality plan.
4. Define the basic process and product plans.
5. Describe goal incongruence.
6. Describe how the various plans relate to each other.
7. Describe the principles of project planning.
8. Describe how goals are defined.
9. Define how plans are communicated.
10. Explain the following:
    A. The business-planning function
    B. The process-planning function
    C. The product- and project-planning functions