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## CAFETERIA PLAN—FLEXIBLE BENEFITS

A cafeteria plan, also called a flexible benefit plan, allows employees to choose from a menu of optional benefits the ones that best fit their individual needs. Thus, employees can customize their benefit packages. In a cafeteria plan, benefits required by law (e.g. Social Security, unemployment compensation, workers's compensation) and those mandated by company policies or labor agreements are supplemented by a list of other benefits to which employees can subscribe. Employees's choices of optional benefits are limited only by the total benefit dollars available and the variety of benefits offered by the employer. Optional benefits that are often part of cafeteria plans include dental insurance, vision care, group-term life insurance, child care, and disability insurance. Many companies offer some form of cafeteria benefit plan to their employees, although smaller companies are less likely to offer flexible benefits than larger companies.

Most cafeteria plans are compliant with Section 125 of the Internal Revenue Code. This means that they meet specific requirements set out by the Internal Revenue Service. Such plans offer the potential of cost savings to both employers and employees, particularly because amounts spent by either the employer or the employee are spent out of pre-tax earnings. Thus, both employers and employees may save on Federal Insurance Contributions Act payroll taxes and the employee may save on state and federal income taxes as well.

### TYPES OF CAFETERIA PLANS

There are several variations of cafeteria plans, including core-plus plans and modular plans. Core-plus plans provide a set of mandatory benefits that are usually designed to meet the basic needs of all employees. In addition to legally-required benefits, medical insurance, long-term disability insurance, and retirement benefits are often included in the core. Optional benefits are offered to employees who spend benefit credits to select other benefits that best fit their needs. Modular plans usually package several different bundles of benefits that offer increasingly extensive arrays of benefits. The basic module might include only the legally-required benefits, basic health insurance, and life insurance. A second module might include everything in the basic module plus additional benefits. A third module might include everything in modules one and two and even more benefits. Employees would choose the module that best fits their needs and life situation.

### PROBLEMS WITH CAFETERIA PLANS

Perhaps the largest problem with cafeteria plans, as opposed to one-size-fits-all benefit plans, is that cafeteria plans are more complicated to administer. Since employees choose individualized benefit packages, the company must take care to record and maintain each employee's benefit package accurately. The company must maintain adequate communication with employees about changes in the cost of benefits, their coverage, and their use of benefits. Employees must also be offered the opportunity to re-visit their benefit choices and make new selections as their needs and life situations change. Additionally, employers must be careful to comply with Internal Revenue Service (IRS) rules and regulations regarding cafeteria plans so that the plans retain their tax-favored status.

Another issue that arises with cafeteria plans is the adverse selection problem. This problem arises

because employees are likely to choose the optional benefits they are most likely to use. If enough employees do this, the cost of the benefit will eventually be driven up, as the premiums received must cover the expenditures of the benefit. For example, suppose a company allows employees to change their cafeteria plan selections once each year. During this "free enrollment" period, an employee who knows (or suspects) that he or she faces extensive dental work in the coming year would be more likely to sign up for dental insurance than the employee who expects only routine dental care. Likewise, an employee who has begun having vision problems would probably be more likely to sign up for vision coverage than an employee with perfect eyesight. Sometimes, employers will place restrictions on certain benefits to try to alleviate the adverse selection problem. Modular plans may also reduce the adverse selection problem, as the employer can package benefits in a way that limits employees's opportunity to choose individual benefits, by requiring them to choose a broad package of benefits.

Given the increasing diversity of the labor force, the demand for benefit packages tailored to individual needs and circumstances is likely to remain strong. Thus, one would expect the number of companies offering flexible benefit plans to continue to increase, as well as the rate of employee participation in such plans.

*SEE ALSO:* Human Resource Management

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## CAPACITY PLANNING

Capacity planning has seen an increased emphasis due to the financial benefits of the efficient use of capacity plans within material requirements planning systems and other information systems. Insufficient capacity can quickly lead to deteriorating delivery performance, unnecessarily increase work-in-process, and frustrate sales personnel and those in manufacturing. However, excess capacity can be costly and unnecessary. The inability to properly manage capacity can be a barrier to the achievement of maximum firm performance. In addition, capacity is an important factor in the organization's choice of technology.

Capacity is usually assumed to mean the maximum rate at which a transformation system produces or processes inputs. Sometimes, this rate may actually be "all at once"—as with the capacity of an airplane. A more usable definition of capacity would be the volume of output per elapsed time and the production capability of a facility.

Capacity planning is the process used to determine how much capacity is needed (and when) in order to manufacture greater product or begin production of a new product. A number of factors can affect capacity—number of workers, ability of workers, number of machines, waste, scrap, defects, errors, productivity, suppliers, government regulations, and preventive maintenance. Capacity planning is relevant in both the long term and the short term. However, there are different issues at stake for each.

### LONG-TERM CAPACITY PLANNING

Over the long term, capacity planning relates primarily to strategic issues involving the firm's major production facilities. In addition, long-term capacity issues are interrelated with location decisions. Technology and transferability of the process to other products is also intertwined with long-term capacity planning. Long-term capacity planning may evolve when short-term changes in capacity are insufficient. For example, if the firm's addition of a third shift to its current two-shift plan still does not produce enough output, and subcontracting arrangements cannot be made, one feasible alternative is to add capital equipment and modify the layout of the plant (long-term actions). It may even be desirable to add additional plant space or to construct a new facility (long-term alternatives).

### SHORT-TERM CAPACITY PLANNING

In the short term, capacity planning concerns issues of scheduling, labor shifts, and balancing resource capacities. The goal of short-term capacity planning is to handle unexpected shifts in demand in an efficient economic manner. The time frame for short-term planning is frequently only a few days but may run as long as six months.

Alternatives for making short-term changes in capacity are fairly numerous and can even include the decision to not meet demand at all. The easiest and most commonly-used method to increase capacity in the short term is working overtime. This is a flexible and inexpensive alternative. While the firm has to pay one and one half times the normal labor rate, it foregoes the expense of hiring, training, and paying additional

benefits. When not used abusively, most workers appreciate the opportunity to earn extra wages. If overtime does not provide enough short-term capacity, other resource-increasing alternatives are available. These include adding shifts, employing casual or part-time workers, the use of floating workers, leasing workers, and facilities subcontracting.

Firms may also increase capacity by improving the use of their resources. The most common alternatives in this category are worker cross training and overlapping or staggering shifts. Most manufacturing firms inventory some output ahead of demand so that any need for a capacity change is absorbed by the inventory buffer. From a technical perspective, firms may initiate a process design intended to increase productivity at work stations. Manufacturers can also shift demand to avoid capacity requirement fluctuation by backlogging, queuing demand, or lengthening the firm's lead times. Service firms accomplish the same results through scheduling appointments and reservations.

A more creative approach is to modify the output. Standardizing the output or offering complimentary services are examples. In services, one might allow customers to do some of the process work themselves (e.g., self-service gas stations and fast-food restaurants). Another alternative—reducing quality—is an undesirable yet viable tactic.

Finally, the firm may attempt to modify demand. Changing the price and promoting the product are common. Another alternative is to partition demand by initiating a yield or revenue management system. Utilities also report success in shifting demand by the use of "off-peak" pricing.

## CAPACITY-PLANNING TECHNIQUES

There are four procedures for capacity planning; capacity planning using overall factors (CPOF), capacity bills, resource profiles, and capacity requirements planning (CRP). The first three are rough-cut approaches (involving analysis to identify potential bottlenecks) that can be used with or without manufacturing resource planning (MRP) systems. CRP is used in conjunction with MRP systems.

Capacity using overall factors is a simple, manual approach to capacity planning that is based on the master production schedule and production standards that convert required units of finished goods into historical loads on each work center. Bills of capacity is a procedure based on the MPS. Instead of using historical ratios, however, it utilizes the bills of material and routing sheet (which shows the sequence or work centers required to manufacture the part, as well as the setup and run time). Capacity requirements can then be determined by multiplying the number of units required by the MPS by the time needed to produce each. Resource profiles are the same as bills of capacity, except lead times are included so that workloads fall into the correct periods.

Capacity requirements planning (CRP) is only applicable in firms using MRP or MRP II. CRP uses the information from one of the previous rough-cut methods, plus MRP outputs on existing inventories and lot sizing. The result is a tabular load report for each work center or a graphical load profile for helping plan-production requirements. This will indicate where capacity is inadequate or idle, allowing for imbalances to be corrected by shifts in personnel or equipment or the use of overtime or added shifts. Finite capacity scheduling is an extension of CRP that simulates job order stopping and starting to produce a detailed schedule that provides a set of start and finish dates for each operation at each work center.

A failure to understand the critical nature of managing capacity can lead to chaos and serious customer service problems. If there is a mismatch between available and required capacity, adjustments should be made. However, it should be noted that firms cannot have perfectly-balanced material and capacity plans that easily accommodate emergency orders. If flexibility is the firm's competitive priority, excess capacity would be appropriate.

*SEE ALSO:* Aggregate Planning; Manufacturing Resources Planning

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# CASE METHOD OF ANALYSIS

The case method of analysis involves studying actual business situations—written as an in-depth presentation of a company, its market, and its strategic

decisions—in order to improve a manager's or a student's problem-solving ability. Cases typically investigate a contemporary issue in a real-life context. There are multiple issues to consider and many "correct" or viable alternatives to solve the case issues are presented. Case studies provide students with a "note of reality" that makes learning more relevant and enjoyable.

Cases are written and published in textbooks by students, faculty, or consultants. Cases may be based on actual company experiences, like a consulting project, or may be developed from articles and events in business periodicals and newspapers. Cases include actual information of a company's decisions and may include interviews, observations, or data from firm and industry records, as well as database records and published historical facts on the company and the industry. Barbazette identified five types of cases studies:

1. Identification cases studies help learners identify positive and negative characteristics of the situation.
2. Problem-solving case studies use systematic and creative problem-solving techniques.
3. Practice case studies require students to use a new idea or try a new skill.
4. Application cases studies are used at the end of a training program to summarize and review.
5. Serial case studies progressively add new elements.

## HISTORY OF CASES

The case method was invented by the Harvard Business School over 80 years ago, where it still remains the foundation for teaching and research. By studying and examining actual cases, professors believed students could develop better insight as to how organizations reach conclusions. This method of study and analysis is seen as an effective way to train young business leaders to consider facts and present them more efficiently.

## POPULARITY OF CASES TODAY

Today, cases remain a popular method of study in business schools—especially at Harvard and the University of Virginia, where they are used heavily in the Master of Business Administration (MBA) programs. While technology, computer simulations, and other learning methods continue to grow, cases fill a much-needed function in the educational process of students, future managers, and leaders. Cases are used in a wide variety of disciplines and areas of study. They are also popular for executive training and are used in weekend-format continuing education and professional development programs.

In their study of the skills of technologists, Birchall and Smith found that technologists are often seen as not having sufficient input into the strategic decision-making process of organizations. Thus, many turn to MBA programs to develop their knowledge, understanding, and personal competencies. The case method has traditionally been used to aid in this educational process. They also stress the use of multimedia tools and groupware to create enhanced learning opportunities based on a dynamic case analysis.

Many groups and organizations also publish cases for educational use. Sources for cases for business schools include:

- The Aspen Institute Business and Society Program
- The Batten Institute, Darden Graduate School of Business, University of Virginia
- Harvard Business School
- Richard Ivey School of Business, University of Western Ontario
- South-Western Publishing Company's CaseNet
- Stanford Graduate School of Business

The American Association for Business Communication, for example, included the best cases for teaching communications in a special issue of *Business Communication Quarterly.* Rogers and Rymer report that their reviewer panel of experienced instructors agreed that the best cases include the following attributes:

- Focus on the discipline
- Require decision making
- Furnish a business context
- Present an engaging story or scenario
- Provide sufficiently-realistic detail for analysis and response
- Function readily in a classroom setting
- Apply to a wide range of teaching philosophies and educational settings
- Relate to contemporary issues and problems

## TEACHING WITH CASES

Cases rely almost exclusively upon discussion to elicit diverse ideas, experiences, and views about case material. Cases allow students to explore actual decisions made by companies. The case presents an account of what happened to a business or industry over a period of time, for example. It includes the events with which managers had to deal and charts

various responses to these decisions. According to Hill and Jones, cases provide students with the experience of organizational problems they have not yet had the opportunity to experience first-hand. In a relatively short period of time, students have the chance to appreciate and analyze problems faced by many different companies and to understand how managers attempted to resolve them. Cases also illustrate underlying business theories.

To prepare a case analysis, students typically read the case several times before a classroom discussion. They first read for a general idea about the problem, the players in the case, the level of the decision, and the type of company or industry presented. On second and subsequent readings, students look for deeper problems and issues and try to differentiate symptoms from real case problems.

Some schools encourage students to research the company by locating articles on the company at the time the case situation occurred. Another research technique is to have students conduct a financial analysis of the company that might include ratio analysis or industry/competitor research. Many schools encourage students to discuss assigned cases in small groups or study teams before class. These teams may develop potential alternatives to solve the problems and ensure each member has considered the relevant facts in the case.

Class discussion occurs in either one large group or several smaller groups. In these groups, participants decide on the solution(s) and the proper course of implementation. They must also consider the time frame for implementation as well as evaluation and success measures. Class members or participants critique the various viable alternatives that are presented. The class is then presented with what the company under study actually did to solve the problem. Some cases are used as quizzes or exams.

Teaching with cases has changed relatively little over the years. However, a new approach, developed by Theroux, is called "real time case method.," In this method, a semester-long case is delivered in weekly installments and focuses on one company and the current events it faces. This method differs from the traditional case study method by its extended coverage and real-timeinteractivity.

## STUDENTS'S PERCEPTIONS OF CASES

Although case method teaching has been used extensively in virtually all business schools for years, little research has been conducted to investigate the effectiveness and usefulness of the method. Among the few studies available is Weil's, which measures students's perceptions. Weil's study confirmed the usefulness of the case method.

Many students favor the case method because there are no "right" or "wrong" answers to the cases. Unlike solving a math or finance problem, there may be multiple ways to reach a successful solution for the case. Diversity of opinion and diversity of group make-up often bring unique solutions to cases. Students learn to respond quickly, formulate answers, speak up, and participate in class discussion. They learn to separate background information from the real problem. They learn to succinctly state problems, to recommend potential alternative solutions, and to explore the pros and cons of each solution. They learn to find hidden information in charts, graphs, tables, and financial data often included in cases.

Some students are discouraged by cases because they do not yield only one, clear answer. Students are forced to develop skills of critical thinking and these skills, while important to today's managers, take time to perfect. Students may also fear presenting their ideas to a large group. They may fear public speaking or presentation in general or they may fear their particular thoughts will be ridiculed by others. Some with limited work or life experience may not feel capable of critiquing a top-level manager's past decisions. However, these unique and fresh ideas often present interesting alternatives.

*SEE ALSO:* Business Plan; Training Delivery Methods

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## CASH FLOW ANALYSIS AND STATEMENT

Cash flow analysis is a method of analyzing the financing, investing, and operating activities of a company. The primary goal of cash flow analysis is to identify, in a timely manner, cash flow problems as well as cash flow opportunities. The primary document used in cash flow analysis is the cash flow statement. Since 1988, the Securities and Exchange Commission (SEC) has required every company that files reports to include a cash flow statement with its quarterly and annual reports. The cash flow statement is useful to managers, lenders, and investors because it translates the earnings reported on the income statement—which are subject to reporting regulations and accounting decisions—into a simple summary of how much cash the company has generated during the period in question. "Cash flow measures real money flowing into, or out of, a company's bank account," Harry Domash notes on his Web site, WinningInvesting.com. "Unlike reported earnings, there is little a company can do to overstate its bank balance."

### THE CASH FLOW STATEMENT

A typical cash flow statement is divided into three parts: cash from operations (from daily business activities like collecting payments from customers or making payments to suppliers and employees); cash from investment activities (the purchase or sale of assets); and cash from financing activities (the issuing of stock or borrowing of funds). The final total shows the net increase or decrease in cash for the period.

Cash flow statements facilitate decision making by providing a basis for judgments concerning the profitability, financial condition, and financial management of a company. While historical cash flow statements facilitate the systematic evaluation of past cash flows, projected (or pro forma) cash flow statements provide insights regarding future cash flows. Projected cash flow statements are typically developed using historical cash flow data modified for anticipated changes in price, volume, interest rates, and so on.

To enhance evaluation, a properly-prepared cash flow statement distinguishes between recurring and nonrecurring cash flows. For example, collection of cash from customers is a recurring activity in the normal course of operations, whereas collections of cash proceeds from secured bank loans (or issuances of stock, or transfers of personal assets to the company) is typically not considered a recurring activity. Similarly, cash payments to vendors is a recurring activity, whereas repayments of secured bank loans (or the purchase of certain investments or capital assets) is typically not considered a recurring activity in the normal course of operations.

In contrast to nonrecurring cash inflows or outflows, most recurring cash inflows or outflows occur (often frequently) within each cash cycle (i.e., within the average time horizon of the cash cycle). The cash cycle (also known as the operating cycle or the earnings cycle) is the series of transactions or economic events in a given company whereby:

1. Cash is converted into goods and services.
2. Goods and services are sold to customers.
3. Cash is collected from customers.

To a large degree, the volatility of the individual cash inflows and outflows within the cash cycle will dictate the working-capital requirements of a company. Working capital generally refers to the average level of unrestricted cash required by a company to ensure that all stakeholders are paid on a timely basis. In most cases, working capital can be monitored through the use of a cash budget.

### THE CASH BUDGET

In contrast to cash flow statements, cash budgets provide much more timely information regarding cash inflows and outflows. For example, whereas cash flow statements are often prepared on a monthly, quarterly, or annual basis, cash budgets are often prepared on a daily, weekly, or monthly basis. Thus, cash budgets may be said to be prepared on a continuous rolling basis (e.g., are updated every month for the next twelve months). Additionally, cash budgets provide much more detailed information than cash flow statements. For example, cash budgets will typically distinguish between cash collections from credit customers and cash collections from cash customers.

A thorough understanding of company operations is necessary to reasonably assure that the nature and timing of cash inflows and outflows is properly reflected in the cash budget. Such an understanding

becomes increasingly important as the precision of the cash budget increases. For example, a 360-day rolling budget requires a greater knowledge of a company than a two-month rolling budget.

While cash budgets are primarily concerned with operational issues, there may be strategic issues that need to be considered before preparing the cash budget. For example, predetermined cash amounts may be earmarked for the acquisition of certain investments or capital assets, or for the liquidation of certain indebtedness. Further, there may be policy issues that need to be considered prior to preparing a cash budget. For example, should excess cash, if any, be invested in certificates of deposit or in some form of short-term marketable securities (e.g., commercial paper or U.S. Treasury bills)?

Generally speaking, the cash budget is grounded in the overall projected cash requirements of a company for a given period. In turn, the overall projected cash requirements are grounded in the overall projected free cash flow. Free cash flow is defined as net cash flow from operations less the following three items:

1. Cash used by essential investing activities (e.g., replacements of critical capital assets).
2. Scheduled repayments of debt.
3. Normal dividend payments.

If the calculated amount of free cash flow is positive, this amount represents the cash available to invest in new lines of business, retire additional debt, and/or increase dividends. If the calculated amount of free cash flow is negative, this amount represents the amount of cash that must be borrowed (and/or obtained through sales of nonessential assets, etc.) in order to support the strategic goals of the company. To a large degree, the free cash flow paradigm parallels the cash flow statement.

Using the overall projected cash flow requirements of a company (in conjunction with the free cash flow paradigm), detailed budgets are developed for the selected time interval within the overall time horizon of the budget (i.e., the annual budget could be developed on a daily, weekly, or monthly basis). Typically, the complexity of the company's operations will dictate the level of detail required for the cash budget. Similarly, the complexity of the corporate operations will drive the number of assumptions and estimation algorithms required to properly prepare a budget (e.g., credit customers are assumed to remit cash as follows: 50 percent in the month of sale; 30 percent in the month after sale; and so on). Several basic concepts germane to all cash budgets are:

1. Current period beginning cash balances plus current period cash inflows less current period cash outflows equals current period ending cash balances.
2. The current period ending cash balance equals the new (or next) period's beginning cash balance.
3. The current period ending cash balance signals either a cash flow opportunity (e.g., possible investment of idle cash) or a cash flow problem (e.g., the need to borrow cash or adjust one or more of the cash budget items giving rise to the borrow signal).

## RATIO ANALYSIS

In addition to cash flow statements and cash budgets, ratio analysis can also be employed as an effective cash flow analysis technique. Ratios often provide insights regarding the relationship of two numbers (e.g., net cash provided from operations versus capital expenditures) that would not be readily apparent from the mere inspection of the individual numerator or denominator. Additionally, ratios facilitate comparisons with similar ratios of prior years of the same company (i.e., intracompany comparisons) as well as comparisons of other companies (i.e., intercompany or industry comparisons). While ratio analysis may be used in conjunction with the cash flow statement and/or the cash budget, ratio analysis is often used as a stand-alone, attention-directing, or monitoring technique.

## ADDITIONAL BENEFITS

In his book, *Buy Low, Sell High, Collect Early, and Pay Late: The Manager's Guide to Financial Survival,* Dick Levin suggests the following benefits that stem from cash forecasting (i.e., preparing a projected cash flow statement or cash budget):

1. Knowing what the cash position of the company is and what it is likely to be avoids embarrassment. For example, it helps avoid having to lie that the check is in the mail.
2. A firm that understands its cash position can borrow exactly what it needs and no more, there by minimizing interest or, if applicable, the firm can invest its idle cash.
3. Walking into the bank with a cash flow analysis impresses loan officers.
4. Cash flow analyses deter surprises by enabling proactive cash flow strategies.
5. Cash flow analysis ensures that a company does not have to bounce a check before it realizes that it needs to borrow money to cover expenses. In contrast, if the cash flow analysis indicates that a loan will be needed several months from now, the firm can turn down the first two offers of terms and have time for further negotiations.

## LOAN APPLICATIONS

Potential borrowers should be prepared to answer the following questions when applying for loans:

1. How much cash is needed?
2. How will this cash help the business (i.e., how does the loan help the business accomplish its business objectives as documented in the business plan)?
3. How will the company pay back the cash?
4. How will the company pay back the cash if the company goes bankrupt?
5. How much do the major stakeholders have invested in the company?

Admittedly, it is in the best interest of the potential borrower to address these questions prior to requesting a loan. Accordingly, in addition to having a well-prepared cash flow analysis, the potential borrower should prepare a separate document addressing the following information:

1. Details of the assumptions underpinning the specific amount needed should be prepared (with cross-references to relevant information included in the cash flow analysis).
2. The logic underlying the business need for the amount of cash requested should be clearly stated (and cross-referenced to the relevant objectives stated in the business plan or some other strategic planning document).
3. The company should clearly state what potential assets would be available to satisfy the claims of the lender in case of default (i.e., the company should indicate the assets available for the collateralization of the loan).
4. Details of the equity interests of major stakeholders should be stated.

In some cases, the lender may also request personal guarantees of loan repayment. If this is necessary, the document will need to include relevant information regarding the personal assets of the major stakeholders available to satisfy the claims of the lender in case of default.

## INADEQUATE CAPITALIZATION

Many businesses fail due to inadequate capitalization. Inadequate capitalization basically implies that there were not enough cash and/or credit arrangements secured prior to initiating operations to ensure that the company could pay its debts during the early stages of operations (when cash inflows are nominal, if any, and cash outflows are very high). Admittedly, it is extremely difficult to perform a cash flow analysis when the company does not have a cash flow history. Accordingly, alternative sources of information should be obtained from trade journals, government agencies, and potential lenders. Additional information can be solicited from potential customers, vendors, and competitors, allowing the firm to learn from others's mistakes and successes.

## UNCONSTRAINED GROWTH

While inadequate capitalization represents a front-end problem, unconstrained growth represents a potential back-end problem. Often, unconstrained growth provokes business failure because the company is growing faster than their cash flow. While many cash flow problems are operational in nature, unconstrained growth is a symptom of a much larger strategic problem. Accordingly, even to the extent that cash flow analyses are performed on a timely basis, such analyses will never overcome a flawed strategy underpinning the unconstrained growth.

## BANKRUPTCY

A company is said to be bankrupt when it experiences financial distress to the extent that the protection of the bankruptcy laws is employed for the orderly disposition of assets and settlement of creditors's claims. Significantly, not all bankruptcies are fatal. In some circumstances, creditors may allow the bankrupt company to reorganize its financial affairs, allowing the company to continue or reopen. Such a reorganization might include relieving the company from further liability on the unsatisfied portion of the company's obligations. Admittedly, such reorganizations are performed in vain if the reasons underlying the financial distress have not been properly resolved. Unfortunately, properly-prepared and timely cash flow analyses can not compensate for poor management, poor products, or weak internal controls.

*SEE ALSO:* Budgeting; Financial Issues for Managers; Financial Ratios; Strategic Planning Tools

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## CELLULAR MANUFACTURING

Cellular manufacturing is a manufacturing process that produces families of parts within a single line or cell of machines operated by machinists who work only within the line or cell. A cell is a small scale, clearly-defined production unit within a larger factory. This unit has complete responsibility for producing a family of like parts or a product. All necessary machines and manpower are contained within this cell, thus giving it a degree of operational autonomy. Each worker is expected to have mastered a full range of operating skills required by his or her cell. Therefore, systematic job rotation and training are necessary conditions for effective cell development. Complete worker training is needed to ensure that flexible worker assignments can be fulfilled.

Cellular manufacturing, which is actually an application of group technology, has been described as a stepping stone to achieving world class manufacturing status. The objective of cellular manufacturing is to design cells in such a way that some measure of performance is optimized. This measure of performance could be productivity, cycle time, or some other logistics measure. Measures seen in practice include pieces per man hour, unit cost, on-time delivery, lead time, defect rates, and percentage of parts made cell-complete.

This process involves placing a cluster of carefully selected sets of functionally dissimilar machines in close proximity to each other. The result is small, stand-alone manufacturing units dedicated to the production of a set or family of parts—or essentially, a miniature version of a plant layout.

While the machinery may be functionally dissimilar, the family of parts produced contains similar processing requirements or has geometric similarities. Thus, all parts basically follow the same routing with some minor variations (e.g., skipping an operation). The cells may have no conveyorized movement of parts between machines, or they may have a flow line connected by a conveyor that can provide automatic transfer.

Cellular manufacturing is a hybrid system that links the advantages of a job shop with the product layout of the continuous flow line. The cell design provides for quick and efficient flow, and the high productivity associated with assembly lines. However, it also provides the flexibility of the job shop, allowing both similar and diverse products to be added to the line without slowing the process. Figures 1 and 2 compares a cellular layout to that of the typical job shop (process layout).

**Figure 1**
**Process Layout**

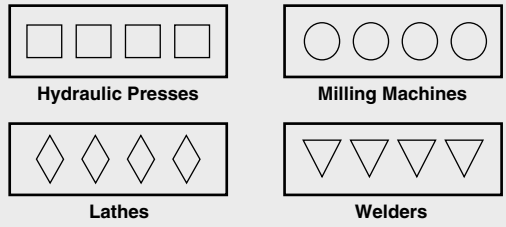
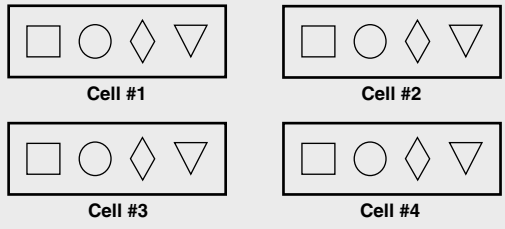



**Figure 2**
**Cellular Layout**




### BENEFITS OF CELLULAR MANUFACTURING

Many firms utilizing cellular manufacturing have reported near immediate improvements in performance, with only relatively minor adverse effects. Cited improvements which seem to have occurred fairly quickly include reductions in work-in-process, finished goods, lead time, late orders, scrap, direct labor, and workspace.

In particular, production and quality control is enhanced. By breaking the factory into small, homogeneous and cohesive productive units, production

and quality control is made easier. Cells that are not performing according to volume and quality targets can be easily isolated, since the parts/products affected can be traced to a single cell. Also, because the productive units are small, the search for the root of problems is made easier.

Quality parameters and control procedures can be dovetailed to the particular requirements of the parts or workpieces specific to a certain cell. By focusing quality control activity on a particular production unit or part type, the cell can quickly master the necessary quality requirements. Control is always enhanced when productive units are kept at a minimum operating scale, which is what cellular manufacturing provides.

When production is structured using cellular manufacturing logic, flow systematization is possible. Grouping of parts or products into sets or families reveals which ones are more or less amenable to continuous, coupled flow. Parts that are standardized and common to many products will have very low changeover times, and thus, are quickly convertible to continuous, line-flow production. Products that are low-volume, high-variety and require longer set-up times can be managed so that they evolve toward a line flow.

Cells can be designed to exploit the characteristics peculiar to each part family so as to optimize the flow for each cell and for groups of cells as a whole. Flow systematization can be done one cell at a time so as to avoid large disruptions in operations. Then the cells that were easy to systemize can provide experience that can be exploited when the more difficult systematization projects occur later. Cells that have been changed to a line flow will invariably show superior performance in the areas of quality, throughput time, and cost, which can lead to eventual plantwide benefit.

Work flow that is adapted to the unique requirements of each product or part allows the plant to produce high-volume and high-variety products simultaneously. Since the cell structure integrates both worker and product versatility into a single unit, it has the potential to attain maximum system flexibility while maintaining factory focus. Cells can be designed around single products, product groups, unique parts, part families, or whatever unique market requirements are identified. For the same part, there may be one high-volume, standardized design and one low-volume customized design. Cells can be built specifically for any of these with a focus on the individual marketing or production requirement called for by the individual product or part.

Systematic job rotation and training in multiple skills also make possible quick, flexible work assignments that can be used to alleviate bottlenecks occurring within the cell. Since normal cell operation requires the workers to master all the skills internal to the cell, little or no additional training should be needed when workers have to be redeployed in response to volume or sales mix changes. When it is routine for workers to learn new skills, they can be easily transferred to another job within the cell or possibly even to an entirely different production unit. Without this worker flexibility and versatility, there can be no real production system flexibility.

## LIMITATIONS

While its benefits have been well documented, it should also be noted that some have argued that implementing cellular manufacturing could lead to a decrease in manufacturing flexibility. It is felt that conversion to cells may cause some loss in routing flexibility, which could then impact the viability of cell use. Obtaining balance among cells is also more difficult than for flow or job shops. Flow shops have relatively fixed capacity, and job shops can draw from a pool of skilled labor so balance isn't that much of a problem. By contrast, with cells, if demand diminishes greatly, it may be necessary to break up that cell and redistribute the equipment or reform the families.

Also, some researchers have warned that the benefits of cellular manufacturing could deteriorate over time due to ongoing changes in the production environment. Finally, it must be noted that conversion to cellular manufacturing can involve the costly realignment of equipment. The burden lies with the manager to determine if the costs of switching from a process layout to a cellular one outweigh the costs of the inefficiencies and inflexibility of conventional plant layouts.

## THE IMPLEMENTATION PROCESS

A wide variety of methods for the implementation of cellular manufacturing have been proposed. These range from complex computer and mathematical models to straightforward applications, such as production flow analysis. A pattern for implementation is now presented.

The first step in implementing cellular manufacturing is to break down the various items produced by the company into a number of part sets or families. The grouping process (group technology) involves identifying items with similarities in design characteristics or manufacturing characteristics, and grouping them into part families. Design characteristics include size, shape, and function; manufacturing characteristics or process characteristics are based on the type and sequence of operations required. In many cases, though not always, the two kinds of characteristics are correlated. Therefore design families may be distinctly different from processing families.

Once identified, similar items can be classified into families. Then a system is developed that facilitates retrieval from a design and manufacturing database. For example, the system can be used to determine if an identical or similar part exists before a completely new part is designed. If a similar part is found, it may be that a simple modification would produce satisfactory results without the expense of new part design. Similarly, planning the manufacturing of a new part after matching it with an existing part family can eliminate new and costly processing requirements.

This grouping of part or product families requires a systematic analysis that often proves to be a major undertaking. Usually, there is a considerable amount of data to analyze, and this in turn can be quite time-consuming and costly. Three primary methods exist for accomplishing the grouping process: visual inspection, examination of design and production data, and production flow analysis. Visual inspection is the least accurate of the three but nonetheless the simplest and the least costly. The most commonly used method of analysis is the examination of design and production data. This method is more accurate but is also more time-consuming. Production flow analysis examines operation sequences and machine routing to uncover similarities (therefore, it has a manufacturing perspective rather than a design perspective). However, unless the operation sequencing and routings are verified, this method could be far from optimal.

The resulting number of families determines the number of cells required, as well as what machines are required within each cell. The cell usually includes all the processing operations needed to complete a part or subassembly. However, it is possible for a product to go from raw materials to packaging and be ready for shipment by the time it reaches the end of the cell.

The families will also help determine where within the cell each machine will be located for the most efficient flow, and how many employees are needed within each cell. After the product families are determined, the machines needed for the production process of a specific family are organized into cells according to processing requirements (e.g., the order of processing). Frequently, machines are grouped in an efficient U-shaped configuration. Since each machine operates on its own for much of the cycle, few workers may be needed, and even then only for a limited number of steps.

The optimal layout is one that minimizes the distance between cells, or the distance to the next production point. The resulting reduction in time and handling ultimately provides a reduction in processing costs. Some firms utilize "linked-cell manufacturing," which is the concept of arranging the manufacturing cells near the assembly cells. Again, this decreases travel distances while reducing materials handling. Hopefully, the floor layout will also provide for the easy flow of a product to shipping, if shipping is located close to the cells in a streamlined flow.

Some plants in advanced stages of cellular manufacturing utilize what is known as a "mini-plant." The cell not only does the manufacturing, but also has its own support services, including its own industrial engineer, quality manager, accountant, and marketing representative and/or salesperson. Only research and development and human resource management are not dedicated to the mini-plant.

An entire facility can be broken down into a number of mini-plants, each of which operates as an independent profit center.

**THE IMPACT OF CELLULAR MANUFACTURING ON WORKERS.** Nancy Hyer and Urban Wemmerlov noted in *Mechanical Engineering* that while technology and processes represent the "hard side" of cells, people represent the "soft side." They state that the soft side factors are far more difficult to change than are the hard side factors. Most implementing firms spend most of their time struggling with soft issues. Cellular manufacturing calls for radical changes in the way industrial work is designed, structured, planned, controlled, and supervised. It makes worker self-management a reality, so management must be convinced that the workers can master all the required aspects of the work.

The decision to implement cellular manufacturing requires a deep commitment to excellence and a desire to permanently change the way factories are viewed and managed. Cellular manufacturing affects workers in a number of ways. Among the factors now discussed are issues of self-management, motivation, employee input, supervision, and group cohesiveness.

**SELF-MANAGEMENT.** Cell workers are encouraged to think creatively about production problems and are expected to arrive at pragmatic solutions to them. While they are free to seek advice from plant management and staff, the identified problems and subsequent analysis, and usually the solutions, are entirely their own. Workers have the authority and are encouraged to implement and follow up on action plans to improve their work. Some managers ask cells to set improvement targets for themselves and measure their performance in comparison to these targets. In addition, workers are given the freedom to plan, coordinate, and control their work within their cell as long as they meet company standards of quality, volume, time, and cost.

**MOTIVATION.** Behavioral psychology proposes that challenging work assignments keep employees motivated, satisfied, and productive. Flexible work assignments within the cells ensure that employees are constantly learning new tasks and constantly being challenged. Job rotation within the cell introduces

variety in work patterns, thereby breaking the monotony (which has been known to cause absenteeism and problems in quality and productivity). Industrial work is productively accomplished in a group work setting. Cellular manufacturing can energize the group, attacking the lethargy found in many industrial situations.

**EMPLOYEE INPUT.** With the cell work group energized and motivated, the employees are more likely to actively and continually bring their mental capabilities to bear on job-related problems. Cell workers are the closest ones to the production process, so practical ideas are likely to instigate other ideas, which could then give rise to a continuous, almost self-sustaining chain reaction of improvement. As the workers see their own creative output being implemented, they begin to develop self-esteem and a stronger desire to succeed. They even begin to challenge each other to improve on their prior accomplishments.

The drive toward excellence is fueled by the human need to achieve until the desire to excel and continuously improve becomes part of the factory culture. Then as workers learn by doing more, they become more proficient at generating ideas which, perpetuates the cycle of improvement. Cellular manufacturing can be the structural catalyst that starts, contains, and sustains the improvement process.

**SUPERVISION.** The intense use of manufacturing cells tends to flatten the factory management structure and reduce overhead costs. When work group autonomy, worker versatility, and small group improvement activities converge, the need for supervision is drastically reduced, if not eliminated all together. Cell manufacturing perpetuates the idea that the work group should supervise itself. A workforce that is motivated, trained, and assigned specific clear responsibility for a product or part, coupled with simplified production planning and control, does not need to be minutely controlled or supervised in order to do a good job.

**GROUP COHESIVENESS.** The creation of small-scale productions dedicated to production of a few similar parts increases work group cohesiveness. Since each cell has few employees, typically less than fourteen, extensive interpersonal contact is unavoidable. The workers are now part of a single, identifiable unit with operating autonomy and responsibility for a specific product, linked by the common purpose of continually improving the productive unit for which they are responsible. The cell structure keeps problems at a level where they are manageable and gives employees the opportunity to exercise their creative potential in a pragmatic way. When problems calling for technical expertise beyond that of the workers, managers and production staff can be called on to provide assistance. Cell manufacturing builds a cohesive subculture within the wider social environment of the plant.

The use of flexible work assignments contributes even more to the group's cohesiveness and loyalty. Employees who regularly perform the work also done by coworkers are more likely to demonstrate empathy and support when dealing with each other on the job. If each worker has experienced each job firsthand, they are more able to offer encouragement and advice on how the work can be improved and each worker is more receptive to the input of his or her coworkers. Each worker can view and understand completely the task, responsibilities, and mission that top management has dedicated to the cell. The cross-fertilization process that emerges can generate some truly creative ideas for process improvement. As the expression goes, "as iron sharpens iron, so shall one man sharpen another."

Finally, work group cohesiveness, reinforced by the cell structure, facilitates total people management. Due to its small scale and mission focus, the cell can be easily mobilized. Top management is too far removed, spatially and socially, from the workers to be able to interact with them extensively enough to significantly control the socialization process. Management can shape corporate values and create a nurturing social environment, but it cannot instill these values into the minds of the lower level employees. Hence, corporate values are better communicated and instilled into daily work habits by small group processes.

The cell is better able to exercise social control over deviant workers since it can directly and immediately manipulate social rewards and punishment. Any worker who fails to conform may find his deviant behavior quickly detected and reacted to by the withdrawal of the social support of the cell. Deviant behavior that is hidden from management for long periods of time is very visible to the small group and can be dealt with quickly.

Conversely, high-performing group members are also quickly visible but are rewarded with esteem and respect from the other cell workers. Consequently, management can work through the cell to instill the corporation's values, attitudes, and philosophies. Once these are internalized by the group's key members, the group itself will take over the socialization process of indoctrinating these values into the mindset of each worker.

## FOCUSED CELLULAR MANUFACTURING

In *International Journal of Operations and Production Management,* Fahad Al-Mubarak and Basheer M. Khumawala discuss a similar alternative

to cellular manufacturing, focused cellular manufacturing (FCM). They define focused cellular manufacturing as a layout scheme that groups components by end-items and forms cell of machine for fabrication and assembly of the end-items. It differs from cellular manufacturing in that it does not attempt to take advantage of process similarities so as to reduce setup times.

The major advantage of FCM is the reduction of completion times for assembled end-items and work-in-process inventories while maintaining some degree of flexibility. In addition, it should be easy to install in a firm producing a few end-items in large volume or many end-items produced in small volume. Apparently, installing a single, focused cell for a few end-items is more practical than installation of many cells as required for a cellular layout.

The flow systematization and physical process integration of cellular manufacturing reinforce each other in potent ways. The underlying mechanisms can be collectively used to push manufacturing to higher performance levels. The result is an effectively designed cellular manufacturing structure, a production operation that integrates many concepts of superior manufacturing performance into a single small-scale production unit whose place in the large manufacturing system is clearly visible.

One final note is to distinguish cellular manufacturing from flexible manufacturing. A flexible manufacturing system is a more fully automated version of cellular manufacturing. A flexible manufacturing system utilizes a computer to control the start of work at each machine and to control the transfer of parts from machine to machine. While quite expensive, flexible manufacturing systems enable manufacturers to achieve some of the benefits of product layouts with small batch sizes provide greater flexibility because the system can operate with little or no human intervention.

*SEE ALSO:* Layout; World-Class Manufacturer

*R. Anthony Inman*

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## CENSUS—ECONOMIC

*SEE:* Economic Census



## CHAIN OF COMMAND PRINCIPLE

The chain of command, sometimes called the scaler chain, is the formal line of authority, communication, and responsibility within an organization. The chain of command is usually depicted on an organizational chart, which identifies the superior and subordinate relationships in the organizational structure. According to classical organization theory the organizational chart allows one to visualize the lines of authority and communication within an organizational structure and ensures clear assignment of duties and responsibilities. By utilizing the chain of command, and its visible authority relationships, the principle of unity of command is maintained. Unity of command means that each subordinate reports to one and only one superior.

### HISTORICAL BACKGROUND

The chain of command principle is ancient, but its application to the management of organizations was only systematized in the twentieth century. Two individuals—the French engineer and executive Henri Fayol and the German sociologist Max Weber—contributed much to our understanding of this principle. In his book, *General and Industrial Management,* Fayol presented what have come to be known as the fourteen principles of management. These principles include both the unity of command (his fourth principle) and the scalar chain (line of authority). Fayol's principle of the unity of command holds that a subordinate should report to one and only one supervisor. Fayol believed that this was necessary to provide the supervisor with clear position authority, and to prevent a subordinate from receiving conflicting orders. Fayol's scalar chain principle states that authority and responsibility flow, one level at a time, in a vertical line from the highest level in an organization to its lowest level. This line of authority establishes an organization's hierarchy. Fayol believed that it was a management error to abandon the chain of command for no reason, but he also allowed for circumstances in which the chain of command might be bypassed for the good of the company. For example, Fayol suggested that communication delays might sometimes be caused by blind adherence to the chain of command

and unity of command principles, and proposed what he called the "gangplank," which allows communications outside the chain of command as long as superiors are made aware. Weber also studied the problems inherent in large organizations, as organizations grew from family structures to much larger entities during the Industrial Revolution (1760–1850). Weber proposed the bureaucracy as a model of efficient organization. Bureaucratic characteristics have clearly defined hierarchies of authority and responsibility, consistent with the chain of command principle.

## CURRENT STATUS

In many organizations, the chain of command principle is still very much alive. The manager's status is that of the deliverer of orders, and the employee enacts them under the monitoring of the manager. Both parties share responsibility for achievements. But, as Longnecker suggests in his book *Principles of Management and Organizational Behavior,* communication provides the underpinnings of this relationship. The discussions and meetings contact managers and their subordinates have may improve or harm the effectiveness of the direct report relationships in the chain of command.

A problem associated with the chain of command occurs when a subordinate bypasses a manager in either the giving of information or the requesting of a decision. This act undermines the authority and position of the manager who is bypassed. If this practice is allowed to continue in a bureaucratically-organized company, morale of the managers will decline. The urgency and frequency of these situations may, of course, mitigate the impact and inappropriateness of such contacts.

With the rapidly-changing environment and increasing uncertainty that organizations face in the twenty-first century, some adopt structures that emphasize flexibility and quick response to change. These types of organizations attempt to place decision-making authority in the organizational structure with those who can most effectively and efficiently respond to environmental imperatives. Thus, these organizations may have flatter hierarchies and communication and decision-making patterns that do not fully adhere to the chain of command or unity of command principles. In the case of matrix organizations, employees frequently have two managers or supervisors, violating the unity of command and chain of command principles. To be effective, individuals working in these organizations learn to share power, use open confrontation to resolve issues, and to utilize all directions in the organization to disseminate information. These more organic structures are not rigidly bound to the chain of command principle, although it is still an important organizing principle in most organizations.

*SEE ALSO:* Management Control; Management Functions; Organizational Chart; Organizational Structure

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Wren, Daniel A. *The Evolution of Management Thought.* 4th ed. New York: John Wiley & Sons, Inc., 1994.

## CHANGE—MANAGING

*SEE:* Managing Change

## CHANGE—REACTIVE VS. PROACTIVE

*SEE:* Reactive vs. Proactive Change

## CHANGE—TRENDS IN ORGANIZATIONS

*SEE:* Trends in Organizational Change

## CHAOS THEORY

Chaos theory is a scientific principle describing the unpredictability of systems. Most fully explored and recognized during the mid-to-late 1980s, its premise is that systems sometimes reside in chaos, generating energy but without any predictability or direction. These complex systems may be weather patterns,

ecosystems, water flows, anatomical functions, or organizations. While these systems's chaotic behavior may appear random at first, chaotic systems can be defined by a mathematical formula, and they are not without order or finite boundaries. This theory, in relation to organizational behavior, was somewhat discounted during the 1990s, giving way to the very similar complexity theory.

## ORIGINS OF CHAOS THEORY

One of the first scientists to comment on chaos was Henri Poincaré(1854–1912), a late-nineteenth century French mathematician who extensively studied topology and dynamic systems. He left writings hinting at the same unpredictability in systems that Edward Lorenz (b. 1917) would study more than half a century later. Poincaré explained, "It may happen that small differences in the initial conditions produce very great ones in the final phenomena. A small error in the former will produce an enormous error in the latter. Prediction becomes impossible." Unfortunately, the study of dynamic systems was largely ignored long after Poincaré's death.

During the early 1960s, a few scientists from various disciplines were again taking note of "odd behavior" in complex systems such as the earth's atmosphere and the human brain. One of these scientists was Edward Lorenz, a meteorologist from the Massachusetts Institute of Technology (MIT), who was experimenting with computational models of the atmosphere. In the process of his experimentation he discovered one of chaos theory's fundamental principles— the Butterfly Effect. The Butterfly Effect is named for its assertion that a butterfly flapping its wings in Tokyo can impact weather patterns in Chicago. More scientifically, the Butterfly Effect proves that forces governing weather formation are unstable. These unstable forces allow minuscule changes in the atmosphere to have major impact elsewhere. More broadly applied, the Butterfly Effect means that what may appear to be insignificant changes to small parts of a system can have exponentially larger effects on that system. It also helps to dispel the notion that random system activity and disturbances must be due to external influences, and not the result of minor fluctuations within the system itself.

Another major contributor to chaos theory is Mitchell Feigenbaum (b. 1944). A physicist at the theoretical division of the Los Alamos National Laboratory starting in 1974, Feigenbaum dedicated much of his time researching chaos and trying to build mathematical formulas that might be used to explain the phenomenon Others working on related ideas (though in different disciplines) include a Berkeley, California mathematician who formed a group to study "dynamical systems" and a population biologist pushing to study strangely-complex behavior in simple biological models. During the 1970s, these scientists and others in the United States and Europe began to see beyond what appeared to be random disorder in nature (the atmosphere, wildlife populations, etc.), finding connections in erratic behavior. As recounted by James Gleick (b.1954) in *Chaos,* a French mathematical physicist had just made the disputable claim that turbulence in fluids might have something to do with a bizarre, infinitely-tangled abstraction he termed a "strange attractor." Stephen Smale (b. 1930), at the University of California, Berkeley, was involved in the study of "dynamical systems." He proposed a physical law that systems can behave erratically, but the erratic behavior cannot be stable. At this point, however, mainstream science was not sure what to make of these theories, and some universities and research centers deliberately avoided association with proponents of chaos theory.

By the mid-1980s, chaos was a buzzword for the fast-growing movement reshaping scientific establishments, and conferences and journals on the subject were on the rise. Universities sought chaos "specialists" for high-level positions. A Center for Nonlinear Studies was established at Los Alamos, as were other institutes devoted to the study of nonlinear dynamics and complex systems. A new language consisting of terms such as *fractals, bifurcations,* and *smooth noodle maps* was born. In 1987, James Gleick published his landmark work, *Chaos: Making a New Science,* chronicling the development of chaos theory, as well as the science and scientists fueling its progress.

## THE SCIENCE OF CHAOS THEORY

As stated by James Gleick, chaos is a science of the "global nature of systems," and so it crosses many disciplinary lines—from ecology to medicine, electronics, and the economy. It is a theory, method, set of beliefs, and way of conducting scientific research. Technically, chaos models are based on "state space," improved versions of the Cartesian graphs used in calculus. In calculus, speed and distance can be represented on a Cartesian graph as *x* and *y.* Chaos models allow the plotting of many more variables in an imaginary space, producing more complex imaginary shapes. Even this model assumes, however, that all variables can be graphed, and may not be able to account for situations in the real world where the number of variables changes from moment to moment.

The primary tool for understanding chaos theory (and complexity theory as well) is dynamic systems theory, which is used to describe processes that constantly change over time (e.g., the ups and downs of the stock market). When systems become dislodged from

a stable state, they go through a period of oscillation, swinging back and forth between order and chaos. According to Margaret J. Wheatley in *Leadership and the New Science,* "Chaos is the final state in a system's movement away from order." When a system does reach that point, the parts of a system are manifest as turbulence, totally lacking in direction or meaning. Wheatley quotes researchers John Briggs and F. David Peat explaining the process of oscillation:

> Evidently familiar order and chaotic order are laminated like bands of intermittency. Wandering into certain bands, a system is extruded and bent back on itself as it iterates, dragged toward disintegration, transformation, and chaos. Inside other bands, systems cycle dynamically, maintaining their shapes for long periods of time. But eventually all orderly systems will feel the wild, seductive pull of the strange chaotic attractor.

In simpler terms, every system has the potential to fall into chaos.

The above "strange attractor" is the very same that a French mathematical physicist identified in the early 1960s. In complex systems, where all should fall apart, the attractor comes in, magnetically pulling system variables into an area and creating a visible shape. Because previous efforts to graph such phenomena could only be completed in two dimensions, this effect could not be visualized. However, computers now allow the phenomena of "strange attractors" to become visible, as images of multiple dimensions representing multiple variables can finally be created.

Part of the difficulty in studying chaos theory arises because complex systems are difficult to study in pieces. Scientists's efforts to separate pieces of dynamical systems often fall apart. The system depends on each minute part of that system and the way it interacts with all other components. As Briggs and Peat state, "The whole shape of things depends upon the minutest part. The part is the whole in this respect, for through the action of any part, the whole in the form of chaos or transformative change may manifest."

In the same breath, it is important to establish the importance of the autonomy the smallest parts of a system possess. Each component of a complex system has the ability to fluctuate, randomly and unpredictably, within the context of the system itself. The system's guiding principles (the attractors) allow these parts to cohere over time into definite and predictable form. This runs contrary to the impression many have of chaos theory, believing there is no order to be had in such a system. But chaotic movement does possess finite boundaries, within which is the capacity for infinite possibility. Even lacking direction, parts of a system can combine so that the system generates multiple configurations of itself, displaying "order without predictability." These systems never land in the same place twice, but they also never exceed certain boundaries.

## PRACTICAL APPLICATION OF CHAOS THEORY

By the early 1980s, evidence accumulated that chaos theory was a real phenomenon. One of the first frequently-cited examples is a dripping water faucet. At times, water drops from a leaky faucet exhibit chaotic behavior (the water does not drip at a constant or orderly rate), eliminating the possibility of accurately predicting the timing of those drops. More recently, the orbit of Pluto was shown to be chaotic. Scientists took advantage of applications using chaos to their benefit; chaos-aware control techniques could be used to stabilize lasers and heart rhythms, among multiple other uses.

Another arena within which chaos theory is useful is that of organizations. Applying chaos theory to organizational behavior allows theorists to take a step back from the management of day-to-day activities and see how organizations function as unified systems. An organization is a classic example of a nonlinear system (i.e., a system in which minor events have the potential to set off grave consequences or chain reactions, and major changes may have little or no effect on the system whatsoever). In order to exploit the chaotic quality of an organization, one needs to try to see the organizational shape that emerges from a distance. Instead of pinpointing causes in the organization for organizational problems, the company is better served, according to chaos theory, by looking for organizational patterns that lead to certain types of behavior within the organization.

Organizational expectations for acceptable behavior, and the degree of freedom with which individuals are allowed to work, shape the way a company's problems and challenges are handled by its members. By allowing people and groups within an organization some autonomy, businesses encourage the organization to organize itself, enacting multiple iterations of its own functioning until the various pieces of the organization can work together most effectively. An organization that encourages this type of management has been termed a *fractal organization,* one that trusts in natural organizational phenomena to order itself.

However, applying chaos theory to organizational practice tends to go against the grain of most formal management patterns. Order can be confused with the more popular notion of control. Defined by organization charts and job descriptions, traditional management does not generally seek to add disorder to its strategic plan. As Wheatley states, "It is hard to open ourselves up to a world of inherentorderliness."

Organizations are focused on structure and design. Charts are drawn to illustrate who is accountable to whom or who plays what role and when. Business experts break down organizations into the smallest of parts. They build models of organizational practice and policy with hope that this atomizing yields better information on how to improve the organization's functioning. However, chaos theory implies that this is unnecessary, even harmful.

Self-organizing systems are those enabled to grow and evolve with free will. As long as each part of the system remains consistent with itself and the systems's past; these systems can harness the power of creativity, evolution, and free will—all within the boundaries of the organization's overall vision and culture. In this respect, chaos theory shows the need for effective leadership, a guiding vision, strong values, organizational beliefs, and open communication.

During the 1980s, chaos theory did begin to change decision-making processes in business. A good example is the evolution of high-functioning teams. Members of effective teams frequently recreate the role each member plays, depending on the needs of the team at a given point. Though not always the formally-designated manager, informal leaders emerge in an organization not because they have been given control, but because they have a strong sense of how to address the needs of the group and its members. The most successful leaders understand that it is not the organization or the individual who is most important, but the relationship between the two. And that relationship is in constant change.

One of the most influential business writers of the 1980s and 1990s, Tom Peters (b. 1942), wrote, *Thriving on Chaos: Handbook for a Management Revolution* in 1987. Peters offers a strategy to help corporations deal with the uncertainty of competitive markets through customer responsiveness, fast-paced innovation, empowering personnel, and most importantly, learning to work within an environment of change. In fact, Peters asserts that we live in "a world turned upside down," and survival depends on embracing "revolution." While not explicitly concerned with chaos theory, Peters's focus on letting an organization (and its people) drive itself is quite compatible with the central tenets of chaos theory.

As the global economy and technology continue to change the way business is conducted on a daily basis, evidence of chaos is clearly visible. While businesses could once succeed as "non-adaptive," controlling institutions with permanently-installed hierarchical structures, modern corporations must be able to restructure as markets expand and technology evolves. According to Peters, "To meet the demands of the fast-changing competitive scene, we must simply learn to love change as much as we have hated it in the past."

Organizational theorist Karl Weick (b. 1936) offers a similar theory to Peters's, believing that business strategies should be "just in time. . .supported by more investment in general knowledge, a large skill repertoire, the ability to do a quick study, trust in intuitions, and sophistication in cutting losses." Though he did not articulate his theories in terms of the explicit ideas offered by quantum physics and chaos theory, his statements support the general idea that the creation and health of an organization (or a system) depends on the interaction of various people and parts within that system. However, as Wheatley states in her book:

> Organizations lack this kind of faith, faith that they can accomplish their purposes in various ways and that they do best when they focus on direction and vision, letting transient forms emerge and disappear. We seem fixated on structures. . .and organizations, or we who create them, survive only because we build crafty and smart—smart enough to defend ourselves from the natural forces of destruction.

*SEE ALSO:* Complexity Theory; Trends in Organizational Change

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## CLOSED SYSTEMS

*SEE:* Open and Closed Systems

## COALITION BUILDING

Coalitions refer to the temporary formation of persons, groups, or even nations for some type of joint or common action. It has been used as a term most often in relation to political or national issues, such as President George H. W. Bush's allied coalition during the Gulf War. In business, coalitions have been present for many years as a means of bringing together people, departments within an organization, entire companies, or industries with some common purpose. Examples of such purposes might include; achieving a common corporate goal, lowering insurance rates, regulating an industry action, or strategic planning. Coalitions are an exercise in power, whether in politics or business.

### HISTORY OF COALITIONS

The concept of coalition building has too often been confused with interest groups and lobbying. The term refers to the formation of different interests, but not necessarily with the same intent as an interest group. From the French *coalascere,* the word is generally defined in political terms. Most early coalitions were temporary alliances formed among nontraditional allies to combat a common foe. Bush's Gulf coalition is one such example, and an example of a coalition that did not hold together even over a short span of time. Coalitions are also formed for election purposes. A historical example of this is the Republican Party, formed in the mid-nineteenth century from representatives from virtually all parties then existing on the American political scene—Whigs, Democrats, Free-Soilers, Abolitionists, Know-Nothings, members of the temperance movement, and others without a party allegiance. All of these elements did not survive the formation of the Republican Party as we know it today.

### COALITIONS DEFINED

There are various definitions of a coalition that fit an organizational behavior setting. One simply states that a coalition occurs when members of a group organize to support their side of a particular issue. Another definition refers to a coalition as a relationship over a specific issue. Coalitions exist to preserve and even enhance self-interests, whether those of an individual or group, and achieve an adequate balance of power favorable to the coalition members's advantage. A more complete definition is a group formed to pursue a strategy that will be to the advantage of those most directly affected.

Another example of a coalition is one that forms over the issue of funding for management information systems within a single organization. Individuals express initial concern about a lack of resources to fully develop an integrated information system, yet have no formal way to share concerns with management. These individuals represent several units within the organization, including accounting, research, marketing, and distribution—few of whom commonly interact with the others. The issue focuses on management's budget control. But, as a group, membership serves on the overall organizational budget planning committee. At the point of decision making, the coalition acts in accord with common interests to recommend a comprehensive information system mutual to the needs of all units. Once this recommendation is forwarded to the organization's executive, the coalition disbands or continues, depending on the final decision on how the resources are to be used for information management.

Whatever definition of coalitions is accepted, understanding organizational coalitions helps to understand behavior in a complex organizational structures. Coalitions are a potent force in organizations. Organizational behavior literature is largely independent of the social psychology literature on coalitions, yet a closer tie between the two fields is building. Likewise, business and organization literature has not utilized the vast literature of political science that examines the unique formation of coalitions for mutual goals. The merging of these three independent disciplines into a body of coalition literature can only enhance our understanding of the formation of groups for common purposes.

### COALITION BUILDING

A review of the business and behavioral science literature on coalitions suggests the following are common characteristics found in most coalitions:

1. Members act as a group.
2. They are formed for a specific purpose.
3. They contain a group of interacting individuals.
4. They are independent from the organization's formal structure.
5. They have no formal structure.
6. They are oriented to a specific issue to advance the group's purpose.
7. Perception of membership is mutual among members.
8. They have an external focus.

These characteristics may be common with other types of groups within organizations, but coalitions are separate and quite often powerful. As a part of an

organizational power structure, coalitions are frequently seen as a manager's legitimate search for power, and as such, are used to increase personal power or to achieve organizational goals. When building a coalition, potential members will identify those individuals or groups who have a common interest or goal and who are most likely to join. Generally, coalitions take time to form as participants identify the common goal, the best manner to approach that goal, and the individuals or groups most likely to share the preferred strategy of goal-seeking. Borrowing from social psychology literature, "Coalitions form one person (or group) at a time."

Coalitions are used to increase a power base. Therefore, an understanding of coalition building is integral to a comprehensive knowledge of organizational behavior. As in politics, the emphasis on the word, "temporary" is closely associated with coalitions, but is not necessarily the rule in corporate life. Social psychologists Keith Murnigham and Danny Brass conclude that successful coalitions are fluid, form rather quickly, expand, burst at the moment of decision, and then rapidly disappear. Other types of relationships within the organization can include alliances, networks, cliques, a supportive managerial relationship, and other forms. Networks are a broad-based cooperative pursuit of general self interests, while alliances involve individuals or groups supporting each other. A clique is a group of individuals held together by a common interest. Cliques often form coalitions. Research indicates that some surreptitiousness (e.g., mobilizing quietly) may be essential to building a coalition. There is also research concluding that resistance, fear of retaliation, and insults often create ripe conditions for coalition building.

Several conditions have to be present for the formation of a coalition. First, there has to be an issue that requires addressing or interest in an issue that coalition members find they have in common. Second, potential members have to share a belief that they can achieve success through building a coalition. Third, there must be an understanding that the action taken has to be jointly performed. Once these criteria are met, the building of the coalition begins. Generally, coalition members form from a weakness—that is, individually they are not strong enough in the organization to achieve their goal.

When this collective action leads to a response, coalitions can take one of several directions. If initially successful, the coalition may grow. But the same is true if the coalition first encounters failure yet persists in reaching a collective goal. Disbanding the coalition is also a possibility in either scenario, resulting in the dormancy of the coalition. Coalitions may well be strengthened by success and continue to grow in power and influence. A dormant coalition may also be able to exercise power at a later time, but this is unlikely in most organizations. Coalitions may prevail and coalition goals may become the dominant organizational goal, although this alternative course of coalition action lacks adequate research findings from which to derive any solid conclusions. The stability of coalitions thus depends on goals, course of action, outcomes, and continued common interest.

## COALITION GOALS

Coalition goals generally focus on the distribution of resources, always a source of contention in organizations. The lack of adequate resources, changes in the resource base, perceived inequitable resource distribution, and lack of a comprehensive understanding of resource allocation frequently result in the development of coalitions. Research also indicates that those with broader discretion and influence in job responsibilities and work activities are more likely to participate in coalition building. When the work environment is more rigidly controlled, coalitions are not as likely to be pursued as a strategy for addressing collective goals.

An example of a coalition and its effectiveness is found in the experience of Transworld Corporation's president Charles Bradshaw. As reported in *Business Week,* Bradshaw's fate as president was doomed by a coalition of forces within the company. At a finance committee meeting where Bradshaw opposed Transworld's acquisition of a nursing home corporation, the committee chair recited an endless list of facts and figures in support of the purchase. Bradshaw reflected, "Within two or three minutes I knew I had lost. No one was talking directly to me, but all statements addressed my opposition. I could tell there was general agreement around the board table." The finance committee assumed the form of a coalition for a common organizational purpose and Bradshaw was defeated on the acquisition issue. Although an example of a very powerful coalition, it includes most of the common characteristics of the coalition—an interacting group (the finance committee), a specific purpose (the nursing home corporation acquisition), a concentrated act (voting together in opposition to Bradshaw), no formal internal structure (a corporate committee), external focus (acquisition of an entity outside the organization), and orientation to advance the members's purpose (the corporate acquisition).

## COALITION LITERATURE

The concept of coalitions has undergone differing applications and meanings within organizational theory. The earliest uses focus on conflicts within organizations and the presence of multiple goals within the same organization. Herbert Simon, former professor

at Carnegie Mellon University and 1978 recipient of the Nobel Prize in economics, was one of the first researchers to identify the issue of conflict over goals in an organization. Simon, however, failed to mention coalitions arising within the organizations over this conflict. Simon's 1958 book, *Organizations,* which he co-authored with James G. March, mentioned coalitions between but not within organizations. March, also at Carnegie Mellon and later at Stanford, did draw a relationship between coalitions and organizations in a 1962 article in the *Journal of Politics.* March continued his work with Richard Cyert (also at Carnegie Mellon at that time and later president of the institution from 1972 to 1990) in works like the 1963, *A Behavioral Theory of the Firm.*

The second significant period of coalition research centered on James Thompson, who adopted the work of March and Cyert in his 1967 book, *Organizations in Action*, where he coined the term, "dominant coalition." Thompson (who was teaching business at Indiana University in 1967) concluded there were certain constraints on coalition building, mainly the organization's technology and environment. Thompson theorized that the more uncertainty in organizations due to technology and environment, the more power bases that exist. The coalition grows as the uncertainty increases.

Thompson also used the term, "inner circle" to describe the select few within an organization whose connections provide them with influence. Their role in coalition building is often one of leadership, but they seldom act alone in achieving goals. Their power is enhanced as the coalition strives to achieve a group goal; thus, the individual and coalition feed off each other. Carrying Thompson's point one step further, interdependency in an organization creates a greater likelihood for the formation of a coalition or coalitions.

A third phase of coalition scholarship was generated with the introduction of political science and social psychology methods and studies to organizational behavior. This led to the current divergent use of the term, and research from several disciplines points to how individual efforts at influence become the basis for coalition building. The application of different schools of research on coalitions led to more thorough study into the formation and operation of coalitions in the organization. In addition, game theory proponents contribute to understanding of the role of coalitions and their formation.

More recently, research into coalitions has moved away from the organizational environment to the political arena where coalitions have an impact on business. Periodical literature is highlighted with articles on how coalitions influence international business and economics, the health care industry, diversity and integration issues, foreign trade, the insurance market, and community activism. In the area of organizational behavior, research centers on the role of coalitions in organizational change, or how groups with seemingly dichotomous interests merge to exercise power on business strategy and decision making within an organization undergoing significant administrative and structural change.

In their seminal article on coalition research, William Stephenson, Jone Pearce, and Lyman Porter (of the University of California at Irvine) state that the study of coalitions has yet to produce any new way of understanding organizational processes. Considering the wide array of research from psychology, political science, game theory, sociology, and organizational behavior, their conclusion still begs an adequate answer. We can come to an understanding of the conditions necessary for the formation of a coalition, how they are built, how they exercise power and influence, and how they survive or disband, yet the question of the role of the coalition in organizational behavior remains unanswered and fertile for the researcher so inclined to look further for questions and answers.

*SEE ALSO:* Group Decision Making; Group Dynamics; Managing Change; Organizational Structure; Teams and Teamwork; Trends in Organizational Change

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## COMMUNICATION

Communication is the sharing or exchange of thought by oral, written, or nonverbal means. To function effectively, managers need to know and be able to apply strategically a variety of communication skills that match varying managerial tasks. These tasks might call for nonverbal, presentational, or written skills as the manager meets others, speaks at meetings, or prepares reports to be read by clients or those higher on the organizational ladder. To work effectively, managers also need to know sources of information. Finally, managers need to understand the different communication channels available.

### UPWARD AND DOWNWARD COMMUNICATION

Information, the lifeblood of any organization, needs to flow freely to be effective. Successful management requires downward communication to subordinates, upward communication to superiors, and horizontal communication to peers in other divisions. Getting a task done, perhaps through delegation, is just one aspect of the manager's job. Obtaining the resources to do that job, letting others know what is going on, and coordinating with others are also crucial skills. These skills keep the organization working, and enhance the visibility of the manager and her division, thus ensuring continued support and promotion.

Downward communication is more than passing on information to subordinates. It may involve effectively managing the tone of the message, as well as showing skill in delegation to ensure the job is done effectively by the right person. In upward communication, tone is even more crucial, as are timing, strategy, and audience adaptation. In neither case can the manager operate on automatic as the messages are sent out.

### THE COMMUNICATION PROCESS

At first glance the communication process, or the steps taken to get message from one mind to another, seems simple enough. As the definition at the opening suggested, the sender has an idea, which he transmits to the receiver through signs—physical sensations capable of being perceived by another. These signs might be a printed or spoken word, a gesture, a handshake, or a stern look, to name just a few. The receiver takes those signs, interprets them and then reacts with feedback.

The process is more complex, though. When communicating, the sender encodes the message. That is, she chooses some tangible sign (something which can be seen, heard, felt, tasted, or smelled) to carry the message to the receiver. The receiver, in turn, decodes that message; that is, he finds meaning in it. Yet the signs used in messages have no inherent meaning; the only meaning in the message is what the sender or receiver attributes to it.

To make sense out of a message, to determine the meaning to attribute to it, the receiver uses perception. With perception, the receiver interprets the signs in a communication interaction in light of his past experience. That is, he makes sense out of the message based on what those signs meant when he encountered them in the past. A firm, quick handshake, for example, may signal "businesslike" to someone because in the past he found people who shook hands that way were businesslike.

### PERCEPTION

No person sees things exactly the same way as another; each has a unique set of experiences, a unique perceptual "filter," through which he or she compares and interprets messages. Making up this filter is the unique blend of education, upbringing, and all of the life experiences of the perceiver. Even in the case of twins, the perceptual filter will vary from between them. When communicating, each receiver uses that filter to give meaning to or make sense out of the experience.

Herein lies the challenge in communication, particularly for managers who need to be understood in order to get things done: getting the receiver to comprehend the message in a way similar to what was intended. While the word "communication" implies that a common meaning is shared between sender and receiver, this is not always the case. Under optimum circumstances, the meaning attributed to the message by the receiver will be close to what was intended by the sender. In most situations, however, the meaning is only an approximation, and may even be contrary to what was intended. The challenge of communication lies in limiting this divergence of meanings between sender and receiver.

While the wide range of potential experiences make communicating with someone from within the same culture a challenge, across cultures the possibilities are even wider and the challenge even greater. What one sign means in one culture might be taken in an entirely different way in another. The friendly Tunisian businessman who holds another man's hand as they walk down the street may be misunderstood in the North American culture, for example. Similarly, an intended signal may mean nothing to someone from another culture, while an unintended one may trigger an unexpected response.

Understanding the dynamics that underlie perception is crucial to effective and successful communication.

Because people make sense out of present messages based on past experiences, if those past experiences differ, the interpretations assigned may differ slightly or even radically depending on the situation. In business communication, differences in education, roles in the organization, age, or gender may lead to radical differences in the meaning attributed to a sign.

## AUDIENCE ADAPTATION

The effective communicator learns early the value of audience adaptation and that many elements of the message can be shaped to suit the receiver's unique perceptual filter. Without this adaptation, the success of the message is uncertain. The language used is probably the most obvious area. If the receiver does not understand the technical vocabulary of the sender, then the latter needs to use terms common to both sender and receiver.

On the other hand, if the receiver has less education than the sender, then word choice and sentence length may need to be adapted to reflect the receiver's needs. For example, if the receiver is skeptical of technology, then someone sending a message supporting the purchase of new data processing equipment needs to shape it in a way that will overcome the perceptual blinders the receiver has to the subject. If the receiver is a superior, then the format of the message might need to be more formal.

## COMMUNICATION BARRIERS

Communication barriers (often also called noise or static) complicate the communication process. A communication barrier is anything that impedes the communication process. These barriers are inevitable. While they cannot be avoided, both the sender and receiver can work to minimize them.

Interpersonal communication barriers arise within the sender or receiver. For example, if one person has biases against the topic under discussion, anything said in the conversation will be affected by that perceptual factor. Interpersonal barriers can also arise between sender and receiver. One example would be a strong emotion like anger during the interaction, which would impair both the sending and receiving of the message in a number of ways. A subtler interpersonal barrier is bypassing, in which the sender has one meaning for a term, while the receiver has another (for example, "hardware" could be taken to mean different things in an interchange).

Organizational barriers arise as a result of the interaction taking place within the larger work unit. The classic example is the serial transmission effect. As a message passes along the chain of command from one level to the next, it changes to reflect the person passing it along. By the time a message goes from bottom to top, it is not likely to be recognized by the person who initiated it.

Although communication barriers are inevitable, effective managers learn to adapt messages to counteract their impact. The seasoned manager, especially when in the role of sender, learns where they occur and how to deal with them. As receiver, she has a similar and often more challenging duty. The effort is repaid by the clearer and more effective messages that result.

## COMMUNICATION REDUNDANCY

While audience adaptation is an important tool in dealing with communication barriers, it alone is not enough to minimize their impact. As a result, communication long ago evolved to develop an additional means to combat communication barriers: redundancy, the predictability built into a message that helps ensure comprehension. Every message is, to a degree, predictable or redundant, and that predictability helps overcome the uncertainty introduced by communication barriers. Effective communicators learn to build in redundancy where needed.

Communication redundancy occurs in several ways. One of the most obvious of these is through simple repetition of the message, perhaps by making a point early and again later into the same message. A long report, by contrast, might have its main points repeated in a variety of places, including the executive summary, the body, and the conclusion.

Another source of redundancy lies in the use of multiple media. Much spoken communication is repeated in the nonverbal elements of the message. A formal oral presentation is usually accompanied with slides, product samples, or videotaped segments to support the spoken word. A person interviewing for a job stresses his seriousness and sincerity with a new suit, a warm handshake, consistent eye contact, and an earnest tone in his voice.

A less obvious but more frequent source of redundancy lies in the grammar and syntax (roughly the word order used) of the message. These back up a message by helping the reader or listener predict the unknown from the known. For example, the role and meaning of an uncertain word at the beginning of a sentence can be determined partly by its placement after the word "the" and before a verb in the sentence, as well as by whether or not the verb takes the singular or plural.

In the previous example, the context in which the written message takes place, the collective meanings of the previous and following sentences, also adds to the predictability. Should noise garble one word of the message, the other words surrounding it can provide the clues needed for understanding, something that

anyone familiar with speaking or reading a foreign language would know. Similarly, in a technical description, the context surrounding an unclear word or concept may be enough to determine its meaning, especially in a carefully constructed message.

A surprising source of communication redundancy lies in the way a message is formatted. In a business environment, format can help the receiver predict what will be in a message. A good example is the traditional annual report, which always carries the same type of information. Similarly, someone reading a memorandum from a colleague can reasonably expect that it will deal with internal business matters.

By contrast, the expectations inherent in a particular format can serve as a source of noise when it contains an unexpected message. For example, a company attempting to be innovative sends out its annual report as a videotape. Many of those receiving it might miss the point since it does not look like an annual report. On the other hand, since it might arouse attention, using a familiar format to package new material can be an effective marketing tool in another application.

As a result of redundancy, in whatever form it may appear, much of any message is predictable. The unpredictable element of the message, the new material that the receiver learns from the interaction, is the information that is inherent in the message. Everything else backs the message.

While managers need skill in all areas of communication, two areas, nonverbal communication and the corporate grapevine, are particularly relevant. Both are often misunderstood, and skill in strategically communicating through them is invaluable.

## NONVERBAL COMMUNICATION

Nonverbal communication occurs when there is an exchange of information through nonlinguistic signs. In a spoken (and to some extent written) message, it consists of everything except the words. Nonverbal communication is a valid and rich source of information and merits close study. As with other elements of communication, the meaning of nonverbal signals depends upon perception. It does not have to be intentional in order to carry meaning to another person.

Nonverbal communication serves a variety of purposes, including sending first impressions such as a warm handshake. It also signals emotions (through tears or smiles), status (through clothing and jewelry), and when one wants to either take or relinquish a turn in conversation (using gestures or drawing a breath). Nonverbal signals can also signal when someone is lying; for example when being deceptive, vocal pitch often rises.

Many think of "body language" as synonymous with nonverbal communication. Body language is a rich source of information in interpersonal communication. The gestures that an interviewee uses can emphasize or contradict what he is saying. Similarly, his posture and eye contact can indicate respect and careful attention. Far subtler, but equally important, are the physical elements over which he has little control, but which still impact the impression he is making on the interviewer. His height, weight, physical attractiveness, and even his race are all sources of potential signals that may affect the impression he is making.

But nonverbal signals come from many other sources, one of which is time. If the interviewee in the previous example arrived ten minutes late, he may have made such a poor impression that his chances for hire are jeopardized. A second interviewee who arrives ten minutes early signals eagerness and promptness.

Haptics is a source of nonverbal communication that deals with touch. An interviewee with a weak handshake may leave a poor impression. The pat on the back that accompanies a verbal "well done" and a written commendation may strongly reinforce the verbal and written statements. Subconsciously, most managers realize that when the permissible level of haptic communication is exceeded, it is done to communicate a message about the state of the parties' relationship. It is either warmer than it had been, or one of the parties wishes it so. Unfortunately, explain Borisoff and Victor, conflict can arise when the two parties involved do not agree on an acceptable haptic level for the relationship.

Nonverbal communication also includes proxemics, a person's relationship to others in physical space. Most are familiar with the idea of a personal space "bubble" that we like to keep around ourselves. In the North American culture, this intimate space may be an 18-inch circle around the person, which only those closest are allowed to invade. Just beyond this space close friends may be tolerated, and acquaintances even farther out. Other cultures may have wider or narrower circles. Table 1 sets out the meanings typically attributed to personal spaces in the North American culture.

Managers also send nonverbal signals through their work environment. These signals can affect the communication process in obvious or subtle ways. For example, a manager may arrange the office so that she speaks to subordinates across a broad expanse of desk. Or, she may choose to be less intimidating and use a round table for conferences. The artifacts she uses in the office may say something about who the manager is, or how she wishes to be seen. The organization also speaks through the space it allots to employees. For example, the perception that a large, windowed, corner office may signal prestige while a tiny, sterile cubicle may convey (intentionally or unintentionally) low status.

**Table 1**
**Proxemic Distances in the North America Culture**

| Zone | Distance | Persons Tolerated |
|---|---|---|
| Intimate | 0 to 18' | Partner/spouse, parents, children |
| Personal | 18' to 4'' | Close friends |
| Social | 4'' to 12'' | Business associates |
| Public | 12'' up | Strangers |

Adapted from Smeltzer and Waltman et al., pp. 234-235

## THE GRAPEVINE

The grapevine is the informal, confidential communication network that quickly develops within any organization to supplement the formal channels. The structure of the grapevine is amorphous; it follows relationship and networking patterns within and outside the organization, rather than the formal, rational ones imposed by the organization's hierarchy. Thus, members of a carpool, or people gathering around the water cooler or in the cafeteria, may be from different divisions of a company, but share information to pass the time. The information may even pass out of the organization at one level and come back in at another as people go from one network to another. For example, a member of a civic group might casually (and confidentially) pass on interesting information to a friend at a club, who later meets a subordinate of the first speaker at a weekend barbecue.

The grapevine has several functions in the organization. For one, it carries information inappropriate for formal media. Fearing legal repercussions, most would rarely use printed media to share opinions on the competence, ethics, or behavior of others. At the same time, they will freely discuss these informally on the grapevine. Similarly, the grapevine will carry good or bad news affecting the organization far more quickly than formal media can.

The grapevine can also serve as a medium for translating what top management says into meaningful terms. For example, a new and seemingly liberal policy on casual dress may be translated as it moves along the grapevine to clarify what the limits of casual dress actually are. As it informally fleshes out or clarifies what is also traveling in the formal channels, the grapevine can also serve as a source of communication redundancy. And when these corporate-sanctioned channels are inaccurate, especially in an unhealthy communication climate, what is on the grapevine is usually trusted far more by those using it than what passes on the formal channels.

Participants in the grapevine play at least one of several roles. The first of these, the liaison, is the most active participant since he both sends and receives information on the grapevine. This person often has a job with easy access to information at different levels of the organization (and often with little commitment to any level). This might be a secretary, a mailroom clerk, a custodian, or a computer technician. Often, too, the liaison is an extrovert and likable. While this role means that the liaison is in on much of what is going on in the organization, he also takes a chance since the information he passes on might be linked back to him.

Another role played in the grapevine is the deadender. This person generally receives information, but rarely passes it on. By far the most common participant in the grapevine, this person may have access to information from one or more liaisons. This role is the safest one to play in the grapevine since the deadender is not linked to the information as it moves through the organization. Many managers wisely play this role since it provides useful information on what is happening within the organization without the additional risk passing it on to others might entail.

The third role is the isolate. For one or more reasons, she neither sends nor receives information. Physical separation may account for the role in a few instances (the classic example is the lighthouse keeper), but the isolation may also be due to frequent travel that keeps the individual away from the main office. Frequently, the isolation can be traced to interpersonal problems or to indifference to what is happening in the organization (many plateaued employees fit in this category). Not surprisingly, top management often plays the role of isolate, although often unwillingly or unknowingly. This isolation may be owing to the kinds of information passing on the grapevine or to the lack of access others have to top management.

Of course, what is passing on the grapevine may affect a person's behavior or role played. The isolate who is close to retirement and indifferent to much of what is going on around him may suddenly become a liaison when rumors of an early retirement package or a cut in health benefits circulate. Meanwhile, the youngest

members of the organization may not give a passing thought to this seemingly irrelevant information.

## COMMUNICATION CHANNELS

Communication channels—or the media through which messages are sent—can have an influence on the success of communication. Typical channels used in business communication are face-to-face conversations, telephone conversations, formal letters, memos, or e-mails. Each channel has its own advantages and disadvantages in communicating a particular message.

Media richness theory indicates that the various communication channels differ in their capability to provide rich information. Face-to-face interaction is highest in media richness, because a person can perceive verbal and nonverbal communication, including posture, gestures, tone of voice, and eye contact, which can aid the perceiver in understanding the message being sent. Letters and e-mails have fairly low media richness; they provide more opportunity for the perceiver to misunderstand the sender's intent. Thus, messages should be communicated through channels that provide sufficient levels of media richness for their purpose. For instance, when managers give negative feedback to employees, discipline them, or fire them, it should be done in person. However, disseminating routine, nonsensitive information is properly done through memos or e-mails, where media richness is not critical.

A communication channel that has grown in popularity in business is electronic mail, or e-mail. E-mail provides almost instantaneous communication around the world, and is often a quick, convenient way to communicate with others. This is particularly true for workers in remote locations, such as telecommuters. E-mail may also allow individuals to get their work done more quickly and to manage communication more effectively, particularly by having a record of previous correspondence easily at hand on their computer.

Despite e-mail's many advantages, there are several problems associated with the increased use of e-mail in business. First, e-mail may not be private; e-mail messages may be accessed by people who were not intended to see the messages, and this may create problems related to keeping trade secrets or managing employee relations. Additionally, e-mail messages may be accessed long after they are sent; they may leave a "paper trail" that an organization would rather not have. A second problem with e-mail use is information overload. Because e-mail is easy and quick, many employees find that they have problems managing their e-mail communication or that their work is constantly interrupted by e-mail arrival. The third problem associated with e-mail is that it reduces the benefits that occur with more media-rich communication. Much of the socialization and dissemination of organizational culture that may occur through personal interactions may be lost with the increased reliance on electronic communication channels.

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# COMPETITIVE ADVANTAGE

Many firms strive for a competitive advantage, but few truly understand what it is or how to achieve and keep it. A competitive advantage can be gained by offering the consumer a greater value than the competitors, such as by offering lower prices or providing quality services or other benefits that justify a higher price. The strongest competitive advantage is a strategy that that cannot be imitated by other companies.

Competitive advantage can be also viewed as any activity that creates superior value above its rivals. A company wants the gap between perceived value and cost of the product to be greater than the competition.

Michael Porter defines three generic strategies that firm's may use to gain competitive advantage: cost leadership, differentiation, and focus. A firm utilizing a cost leadership strategy seeks to be the low-cost producer relative to its competitors. A differentiation strategy requires that the firm possess a "non-price" attribute that distinguishes the firm as superior to its peers. Firms following a focus approach direct their attention to narrow product lines, buyer segments, or geographic markets. "Focused" firms will use cost or differentiation to gain advantage, but only within a narrow target market.

## COST ADVANTAGE RESULTING FROM EFFICIENCY

Efficiency is the ratio of inputs to outputs. Inputs can be any materials, overhead, or labor that is assigned to the product or service. The outputs can be measured as the number of products produced or services performed. The firm that can achieve the highest efficiency for the same service or product can widen the gap between cost and perceived value and may have greater profit margins.

There are many ways a company can increase efficiency. Efficiency is enhanced if, holding outputs constant, inputs are reduced; or if holding inputs constant, outputs are increased. Inputs can be reduced in many ways. Labor inputs can be reduced if employees are better trained so that time spent on each individual output is decreased.

Decreasing waste can decrease materials needed. If a method can be devised to decrease waste, it would increase efficiency. For instance, a bottling plant might determine that 10 gallons of liquid are spilled every day as a result of the bottling process. If the amount of lost liquid can be reduced, efficiency will increase.

Outputs can be increased by increasing the number of units a machine can produce in given period of time. Decreasing downtime can also increase outputs. For example, if a machine regularly breaks down and is out of order for two hours a day, finding a way to eliminate this downtime would increase the number of outputs.

It is often argued that large companies, by definition, are able to be more efficient because they can achieve economies of scale that others are not able to reach. Large companies usually offer more products in each product line, and their products may help to satisfy many different needs. If a consumer is not sure of the exact product he needs, he can go to the larger producer and be confident that the larger producer has something to offer. The consumer might believe that the smaller producer may be too specialized. Larger companies can cater to a larger population because of sheer size, while smaller companies have fewer resources and must specialize or fall victim to larger, more efficient companies.

## PRODUCT DIFFERENTIATION

Product differentiation is achieved by offering a valued variation of the physical product. The ability to differentiate a product varies greatly along a continuum depending on the specific product. There are some products that do not lend themselves to much differentiation, such as beef, lumber, and notebook paper. Some products, on the other hand, can be highly differentiated. Appliances, restaurants, automobiles, and even batteries can all be customized and highly differentiated to meet various consumer needs. In *Principles of Marketing* (1999), authors Gary Armstrong and Philip Kotler note that differentiation can occur by manipulating many characteristics, including features, performance, style, design, consistency, durability, reliability, or reparability. Differentiation allows a company to target specific populations.

It is easy to think of companies that have used these characteristics to promote their products. Maytag has differentiated itself by presenting "Old reliable," the Maytag repairman who never has any work to do because Maytag's products purportedly function without any problems and do not require repairs. The Eveready Battery Co./Energizer has promoted their products' performance with the Energizer Bunny® that "keeps going and going."

Many chain restaurants differentiate themselves with consistency and style. If a consumer has a favorite dish at her local Applebee's restaurant, she can be assured it will look and taste the same at any Applebee's restaurant anywhere in the country. And, the style of theme restaurants is the key to some establishments. Planet Hollywood and Hard Rock Cafe profit from their themes.

In the auto industry, durability is promoted by Chevrolet's "Like a Rock" advertising campaign.

## SERVICE DIFFERENTIATION

Companies can also differentiate the services that accompany the physical product. Two companies can offer a similar physical product, but the company that offers additional services can charge a premium for the product. Mary Kay cosmetics offers skin-care and glamour cosmetics that are very similar to those offered by many other cosmetic companies; but these products are usually accompanied with an informational, instructional training session provided by the consultant. This additional service allows Mary Kay to charge more for their product than if they sold the product through more traditional channels.

In the personal computer business, Dell and Gateway claim to provide excellent technical support services to handle any glitches that may occur once a consumer has bought their product. This 24-hour-a-day tech support provides a very important advantage over other PC makers, who may be perceived as less reliable when a customer needs immediate assistance with a problem.

## PEOPLE DIFFERENTIATION

Hiring and training better people than the competitor can become an immeasurable competitive advantage for a company. A company's employees are

often overlooked, but should be given careful consideration. This human resource-based advantage is difficult for a competitor to imitate because the source of the advantage may not be very apparent to an outsider. As a *Money* magazine article reported, Herb Kelleher, CEO of Southwest Airlines, explains that the culture, attitudes, beliefs, and actions of his employees constitute his strongest competitive advantage: "The intangibles are more important than the tangibles because you can always imitate the tangibles; you can buy the airplane, you can rent the ticket counter space. But the hardest thing for someone to emulate is the spirit of your people."

This competitive advantage can encompass many areas. Employers who pay attention to employees, monitoring their performance and commitment, may find themselves with a very strong competitive advantage. A well-trained production staff will generate a better quality product. Yet, a competitor may not be able to distinguish if the advantage is due to superior materials, equipment or employees.

People differentiation is important when consumers deal directly with employees. Employees are the frontline defense against waning customer satisfaction. The associate at Wal-Mart who helps a customer locate a product may result in the customer returning numerous times, generating hundreds of dollars in revenue. Home Depot prides itself on having a knowledgeable sales staff in their home improvement warehouses. The consumer knows that the staff will be helpful and courteous, and this is very important to the consumer who may be trying a new home improvement technique with limited knowledge on the subject.

Another way a company can differentiate itself through people is by having a recognizable person at the top of the company. A recognizable CEO can make a company stand out. Some CEOs are such charismatic public figures that to the consumer, the CEO is the company. If the CEO is considered reputable and is well-liked, it speaks very well for the company, and consumers pay attention. National media coverage of CEOs has increased tremendously, jumping 21 percent between 1992 and 1997 (Gaines-Ross).

## IMAGE DIFFERENTIATION

Armstrong and Kotler pointed out in *Principles of Marketing* that when competing products or services are similar, buyers may perceive a difference based on company or brand image. Thus companies should work to establish images that differentiate them from competitors. A favorable brand image takes a significant amount of time to build. Unfortunately, one negative impression can kill the image practically overnight. Everything that a company does must support their image. Ford Motor Co.'s former "Quality is Job 1" slogan needed to be supported in every aspect, including advertisements, production, sales floor presentation, and customer service.

Often, a company will try giving a product a personality. It can be done through a story, symbol, or other identifying means. Most consumers are familiar with the Keebler Elves and the magic tree where they do all of the Keebler baking. This story of the elves and the tree gives Keebler cookies a personality. When consumers purchase Keebler cookies, they are not just purchasing cookies, but the story of the elves and the magic tree as well. A symbol can be an easily recognizable trademark of a company that reminds the consumer of the brand image. The Nike "swoosh" is a symbol that carries prestige and makes the Nike label recognizable.

## QUALITY DIFFERENTIATION

Quality is the idea that something is reliable in the sense that it does the job it is designed to do. When considering competitive advantage, one cannot just view quality as it relates to the product. The quality of the material going into the product and the quality of production operations should also be scrutinized. Materials quality is very important. The manufacturer that can get the best material at a given price will widen the gap between perceived quality and cost. Greater quality materials decrease the number of returns, reworks, and repairs necessary. Quality labor also reduces the costs associated with these three expenses.

## INNOVATION DIFFERENTIATION

When people think of innovation, they usually have a narrow view that encompasses only product innovation. Product innovation is very important to remain competitive, but just as important is process innovation. Process innovation is anything new or novel about the way a company operates. Process innovations are important because they often reduce costs, and it may take competitors a significant amount of time to discover and imitate them.

Some process innovations can completely revolutionize the way a product is produced. When the assembly line was first gaining popularity in the early twentieth century, it was an innovation that significantly reduced costs. The first companies to use this innovation had a competitive advantage over the companies that were slow or reluctant to change.

As one of the first Internet service providers, America Online offered a unique innovation for accessing the nascent Internet—its unique and user-friendly

interface. The company grew at a massive rate, leading the rapidly developing Internet sector as a force in American business. While most innovations are not going to revolutionize the way that all firms operate, the small innovations can reduce costs by thousands or even millions of dollars, and large innovations may save billions over time.

## SUSTAINABLE COMPETITIVE ADVANTAGE

The achievement of competitive advantage is not always permanent or even long lasting. Once a firm establishes itself in an area of advantage, other firms will follow suit in an effort to capitalize on their similarities. A firm is said to have a "sustainable" competitive advantage when its competitors are unable to duplicate the benefits of the firm's strategy. In order for a firm to attain a "sustainable" competitive advantage, its generic strategy must be grounded in an attribute that meets four criteria. It must be:

- Valuable—it is of value to consumers.
- Rare—it is not commonplace or easily obtained.
- Inimitable—it cannot be easily imitated or copied by competitors.
- Non-substitutable—consumers cannot or will not substitute another product or attribute for the one providing the firm with competitive advantage.

## SELECTING A COMPETITIVE ADVANTAGE

A company may be lucky enough to identify several potential competitive advantages, and it must be able to determine which are worth pursuing. Not all differentiation is important. Some differences are too subtle, too easily mimicked by competitors, and many are too expensive. A company must be sure the consumer wants, understands, and appreciates the difference offered.

The maker of expensive suits may offer its suits in the widest array of colors, but if 95 percent of the consumers wear only black and navy blue suits, then the wide array of colors adds little perceived value to the product. Variety would not become a competitive advantage, and would be a waste of resources. A difference may be worth developing and promoting, advise Armstrong and Kotler, if it is important, distinctive, superior, communicable, preemptive, affordable, and profitable.

A competitive advantage can make or break a firm, so it is crucial that all managers are familiar with competitive advantages and how to create, maintain, and benefit from them.

*SEE ALSO:* Economies of Scale and Economies of Scope; Porter's 5-Forces Model

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# COMPETITIVE INTELLIGENCE

Intelligence is information that has been analyzed for decision making. It is important to understand the difference between information and intelligence. Information is the starting point; it is readily available numbers, statistics, bits of data about people, companies, products, and strategies. As a matter of fact, information overload is one of the leading problems of today's executive and the top reason for needing a competitive intelligence expert. Information becomes intelligence when is it distilled and analyzed. Combining this idea with those of competition or competitors leads to the concept of gathering and analyzing information about competitors for use in making management decisions. Competitive intelligence provides a link between information and business strategies and decisions. It is the process of turning vast quantities of information into action.

The field of competitive intelligence, as a profession, is relatively new in the U.S. An indication of the importance of competitive intelligence is the growth, since 1986, of the Society of Competitor Intelligence Professionals (SCIP), an organization committed to developing, improving, and promulgating the methods, techniques, and ethical standards of the group. SCIP defines competitive intelligence as "the legal and ethical collection and analysis of information regarding the capabilities, vulnerabilities, and intentions of business competitors conducted by using information databases and other 'open sources' and through ethical inquiry." The major research firm in the field, Fuld & Company, Inc., defines it as "information that has

been analyzed to the point where you can make a decision and a tool to alert management to early warning of both threats and opportunities. Competitive intelligence offers approximations and best views of the market and the competition. It is not a peek at the rival's financial books." Competitive intelligence can help managers discover new markets or businesses, beat the competition to market, foresee competitor's actions, determine which companies to acquire, learn about new products and technologies that will affect the industry, and forecast political or legislative changes that will affect the company.

## EXAMPLES

Examples of competitive intelligence include stock traders who analyze the data on prices and price movements to determine the best investments. These stock traders have the same data as other traders, but analysis of the data separates them from others. Another example is the Japanese automobile industry's analysis of the U.S.-automobile market in the 1970s. High gasoline prices and smaller families created a demand in the United States for smaller, more fuel-efficient cars. Japanese automakers employed competitive intelligence methods to determine this trend and then made manufacturing decisions based on it, beating the U.S. Big Three to market with high quality, fuel-efficient cars. Another example of successful use of competitive intelligence is AT&T's database of in-company experts. Part of this service is the monitoring of companies with which their own employees are most interested. This led to some early insights of emerging competitors. A final example is how Wal-Mart stores studied problems Sears had with distribution, and built a state-of-the art distribution system so that Wal-Mart customers were not frustrated by out-of-stock items, as were Sears's customers.

## ETHICAL METHODS

Competitive intelligence is not spying on the competition. It has been associated in the past with the political and military intelligence used during the Cold War era. Because of this association, many people think that competitive intelligence uses illegal, shady, or unethical means to gather information about competitors. Visions of wiretapping, bribing competitor's employees, or stealing information come to mind. This is not true today. Such techniques can damage the reputation and image of corporations and are not worth the risk. SCIP takes a strong position on the importance of ethics and developed a code of ethics for members. Note the words, "legal and ethical," and the emphasis on retrieving data from "open sources." Competitive intelligence experts use openly-available information. They do dig into public records and government databases and use the latest technology (such as satellite photoreconnaissance and software tools such as spiders) to help gather and analyze large datasets. However, the professionals and companies for which they work do not use illegal methods.

## THE PROCESS

Today, competitive intelligence is an important activity within corporations, serving all areas of business functioning: research and development, human resources, sales, etc. A recent survey by The Futures Group found that 80 percent of large, U.S.-based organizations have a formal, in-house, competitive intelligence department. In the future, competitive intelligence activities will become standard. The wide availability of information on the Web makes competitive intelligence more accessible to medium-size and small firms. Software tools to analyze and disseminate intelligence also make it easier to implement competitive intelligence tools. The process of competitive intelligence is outlined in the following steps:

1. Setting intelligence objectives (i.e., designing the requirements)
2. Collecting and organizing data about the industry and competitors
3. Analyzing and interpreting the data
4. Disseminating the intelligence

**SETTING THE OBJECTIVES.** A clear statement of the intelligence needs of the organization should be outlined by management. If this step is ignored, the competitive intelligence department will be bogged down with too much information and possibly distracted by ad-hoc requests for data. This step is necessary regardless of where in the organization the competitive intelligence department is located. Some corporations have competitive intelligence report directly to the CEO; in others, it is located in marketing or in research and development. The role of any competitive intelligence program should be driven by the needs of the corporation, especially areas that have key performance consequences.

**COLLECTING AND ORGANIZING THE DATA.** The online revolution has enhanced ease in collecting and obtaining information, but the competitive intelligence expert must constantly be alert to new sources and places for finding information. The most obvious data collection sources include trade magazine and newspaper articles, company Web sites, newswires, chat forums, and Web search engines. Free information is available on industries via census data on government Web pages. Similarly, free public company information from U.S. Securities and Exchange Commission (SEC) filings, such as the 10-K and 10-Q report, can be easily obtained

on the Web. These corporate reports yield detailed financial and product information and also identify mergers, acquisitions, and legal proceedings against the company. Other channels for fee-based data are information aggregators such as Factiva, Lexis Nexis, Hoover's Online, MergentOnline and Standard and Poors's databases. Analyst reports and market research reports from companies such as Jupiter, Forrester Research, and Frost and Sullivan, although usually quite expensive to acquire, provide detailed analyses on companies and industries.

**ANALYZING AND INTERPRETING THE DATA.** Analysis and interpretation is the real core of competitive intelligence. Collected data must be transformed into "qualitative" information (i.e., intelligence). One way to analyze data obtained from the Web is to use a Spider. There are competitive intelligence Spiders available that index and categorize documents found though Web searchers. Whether a Spider is used or not, the next step is to interpret the information. Lehmann and Winer outline four important aspects competitive intelligence professionals need to interpret about competitors: their current and future objectives, their current strategies, their resources, and their future strategies. Once this assessment is complete, competitive intelligence professionals measure their companies in comparison to competitors; this is known as benchmarking. From the benchmarking process, trend identification and prediction can be made.

**DISSEMINATING THE INFORMATION.** Dissemination is the delivery of current, real-time intelligence to the decision makers in the firm at the time they need it. Timely dissemination is essential if the intelligence is to be perceived as trustworthy. The current philosophy is that delivering to people at all levels in the organization enhances competitive advantages.

## HISTORY AND LITERATURE

Competitive intelligence is, in part, an outgrowth of the military intelligence field. Within corporations, it is a direct outgrowth, or evolution, of market research, which uses investigation (especially understanding the strategies, capabilities, and options of competitors or rivals) to examine the marketplace. Examining marketing research books at the time competitive intelligence emerged helps identify the shift. Market research differs from competitive intelligence in that it is usually conducted when a new product is in the planning or development stage and often utilizes surveys, focus groups, and other research tools to study the market. Competitive intelligence requires a more continuous and structured scanning of competitors and the environment. William T. Kelly's work introduced the field of intelligence in his 1965 text. Michael E. Porter's books, aimed at practitioners, identify competitive intelligence as a needed business function. Porter's books outline the tools for analyzing competitors and evaluating their strengths and weaknesses, which can then lead to opportunities. Leonard Fuld's work helped revolutionize and define the field. Fuld is a key writer and the founder of a major consulting firm that trains people in competitive intelligence methods and techniques.

## THE COMPETITIVE INTELLIGENCE EXPERT

The competitive intelligence expert or analyst usually has a strong business background, combined with experience in the company. Likely candidates for the assignment are generally research-oriented people in sales, marketing, or research and development. Combining research skills with communication and writing skills is essential. Because of the research orientation of the job, people with library or information science backgrounds in the company are logical choices.

## ORGANIZATIONS

**THE SOCIETY OF COMPETITIVE INTELLIGENCE PROFESSIONALS (SCIP).** The Society of Competitive Intelligence Professionals (SCIP), established in 1986, is a global, nonprofit, membership organization for everyone involved in creating and managing business knowledge. The mission of SCIP is to enhance the skills of knowledge professionals to help their companies achieve and maintain a competitive advantage. SCIP publishes the following influential periodicals:

- *Competitive Intelligence Magazine.* A bimonthly publication with articles by peers in the competitive intelligence profession.
- *Journal of Competitive Intelligence and Management.* A quarterly, international, blind-refereed journal covering all aspects of competitive intelligence and related management fields. This journal seeks to further the development of competitive intelligence and to encourage greater understanding of the management of competition.
- *Competitive Intelligence Review.* A journal archive for peer-reviewed research and case studies focused on the practice of competitive intelligence. Archive includes contents listings, summaries, and articles from past journal issues, dated 1990 to 2001.
- *SCIP Online.* SCIP's email newsletter, sent free to all members twice a month.

**COMPETITIVE INTELLIGENCE DIVISION OF THE SPECIAL LIBRARIES ASSOCIATION (SLA).** This organization was formed in 2004 as an association for corporate librarians and information professionals who have evolved

beyond collecting and managing information, to provide examination of data that can help their organizations succeed. The Competitive Intelligence Division encompasses all aspects of competitive intelligence including: (1) planning, (2) identifying decision makers's intelligence needs, (3) collecting and analyzing information, (4) disseminating intelligence products and services, (5) evaluating intelligence activities, (6) promoting intelligence services among a client base, and (7) additional industry-specific issues. Competitive Intelligence Division members concentrate on developing their competitive intelligence skills to assist them in functioning more effectively as intelligence professionals within their respective organizations.

**FULD & COMPANY, INC.** Fuld & Company, Inc., is a research and consulting firm in the field of business and competitive intelligence. This company, founded by Leonard Fuld in 1979, is a full-service business intelligence firm providing: (1) research and analysis, (2) strategic consulting, (3) business intelligence process consulting, and (4) training to help clients understand the external competitive environment.

**THE INSTITUTE FOR STRATEGY AND COMPETITIVENESS AT HARVARD SCHOOL OF BUSINESS.** This Institute, led by Michael E. Porter, studies competition and its implications for company strategy; the competitiveness of nations, regions and cities; and solutions to social problems. Based at Harvard Business School, the Institute is dedicated to extending the research pioneered by Professor Porter and disseminating it to scholars and practitioners on a global basis.

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## COMPLEXITY THEORY

The basic premise of complexity theory is that there is a hidden order to the behavior (and evolution) of complex systems, whether that system is a national economy, an ecosystem, an organization, or a production line. In business and finance, complexity theory places its focus on the ways a factory or company resemble an ecosystem or market, rather than a machine "whose parts and functions have been plucked out in advance," according to David Berreby. He maintains that the organization of systems is no accident, but "the results of laws of nature that we don't yet fully understand." Once understood, managers will learn that if left to function on their own, systems organize themselves, bringing about "order for free."

Proponents of complexity theory believe specific traits are shared by most complex systems. These systems are the combination of many independent actors behaving as a single unit. These actors respond to their environment, much as stock markets respond to news of changing economies, genes respond to natural

selection, or the human brain responds to sensory input. All of these "networks" also act as a single system made of many interacting components. Complexity theory attempts to explain how even millions of independent actors can unintentionally demonstrate patterned behavior and properties that, while present in the overall system, are not present in any individual component of that system.

Complexity theory was founded on researchers's attempts to rationalize the behavior of large and complex systems, believing they cannot be explained by usual rules of nature. It attempts to discover how the many disparate elements of a system work with each other to shape the system and its outcomes, as well as how each component changes over time. It is also one way to express the perceived domination of systems over their myriad smaller influences.

While complexity theory is strikingly similar to chaos theory, complexity theorists maintain that chaos, by itself, does not account for the coherence of self-organizing, complex systems. Rather, complex systems reside at the edge of chaos—the actors or components of a system are never locked in to a particular position or role within the system, but they never fall completely out of control. As M. Mitchell Waldrop states in *Complexity,* "The edge of chaos is the constantly shifting battle zone between stagnation and anarchy, the one place where a complex system can be spontaneous, adaptive, and alive."

Sherry Turkle, author of *Life on the Screen* and professor of sociology of science at the Massachusetts Institute of Technology (MIT), feels that technology has helped bring the issues of complexity theory to life. She asserts that computers helped persuade us that knowing all the parts of a system (or a computer) cannot give anyone the ability to foresee all the complexity that can arise as all of those parts interact.

## ORIGINS OF COMPLEXITY THEORY

Much of the research on complexity theory originates from the Sante Fe Institute in New Mexico, a mecca for those studying complexity theory. George A. Cowan, head of research at the Los Alamos nuclear laboratory, founded the Santa Fe Institute in the mid-1980s. Scientists at the institute claim that through the study of complexity theory, one can see not only the laws of chaos, but also those of order—through which a powerful explanation for how any collection of components will organize itself can be generated.

One of complexity theory's leading proponents is Stuart Kauffman, author of *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity.* Also a member of the Santa Fe Institute, Kauffman states, "Life exists at the edge of chaos I suspect that the fate of all complex adapting systems in the biosphere—from single cells to economies—is to evolve to a natural state between order and chaos, a grand compromise between structure and surprise." Kauffman's theories originated during his pre-medicine days, when his studies of genetics began to inspire questions about DNA and genetic structures. Kauffman felt that there had to be some kind of built-in order, that trial and error was too much of a long shot to be responsible for the perfect biomolecular structure of the human genome.

Other researchers with a stronger focus on the business side of complexity theory are Howard Sherman and Ron Schultz, authors of *Open Boundaries* and fellows at Santa Fe Center for Emergent Strategies in collaboration with the Santa Fe Institute. They believe business today is faster and nonlinear (effects are not proportional to their causes), and that "experts" cannot predict which products or companies will succeed. Sherman and Schultz assert that competitive advantage is fleeting, and that change can rapidly turn assets into dead weight.

Another major contributor to complexity theory is John Holland, a computer scientist and professor at the University of Michigan. Holland designed the genetic algorithm based on the idea that components of complex systems can be broken down into building blocks, whose characteristics can then be represented in code. In simulations, units of code recombine to make "offspring"; the best of these offspring are allowed to reproduce, while the worst are discarded. As the algorithm works, better code evolves, and the results can be translated into real-world applications.

## DETAILS OF COMPLEXITY THEORY

A complex system is defined as one in which many independent agents interact with each other in multiple (sometimes infinite) ways. This variety of actors also allows for the "spontaneous self-organization" that sometimes takes place in a system. This self-organization occurs without anyone being in charge or planning the organization. Rather, it is more a result of organisms/agents constantly adapting to each other. The complex systems are also adaptive (i.e., they always adapt in a way that benefits them). As an analogy, Waldrop suggests analogy to the way the human brain adapts to learn from experience.

Another important concept in complexity theory is that there is no master controller of any system. Rather, coherent system behavior is generated by the competition and cooperation between actors that is always present. And the components of a system do have different levels of organization—like an organization made up of divisions, which contain different departments, which are in comprised of different

workers. But the important differentiation from this "organization," made by John Holland in *Complexity,* is that "complex adaptive systems are constantly revising and rearranging their building blocks as they gain experience. A firm will promote individuals who do well and (more rarely) will reshuffle its organizational chart for greater efficiency. Countries will make new trading agreements or realign themselves into whole new alliances."

Another important part of complexity theory is its assumption that there are principles underlying all "emergent properties," or traits that emerge from the interactions of many different actors. David Berreby uses the analogy of an ant colony that switches to a better food source. No individual ant made the decision; it was a result of their interactions.

One of the defining characteristics of complex systems is the inability to predict the outcome of any given change to the system. Because a system depends on so many intricate interactions, the number of possible reactions to any given change is infinite. Minor events can have enormous consequences because of the chain of reactions they might incite. Conversely, major changes may have an almost insignificant effect on the system as a whole. Because of this, strong control of any complex system may be impossible. While it may have order, no one absolutely governs a complex system.

Scientists create computer simulations that enable them to better identify emerging patterns in a system. They also write modification programs allowing system components to adapt to changes in the environment without the absolute necessity of radical changes to the overall structure. Computers can use these simulations to design production schedules and optimize assembly line performance.

## COMPLEXITY THEORY IN BUSINESS

Complexity theory is used in business as a way to encourage innovative thinking and real-time responses to change by allowing business units to self-organize. Sherman and Schultz (as related by Hout) argue that modern business moves in a nonlinear fashion, with no continuity in the flow of competitive events, except when observed from hindsight. In order to effectively put complexity theory to work, however, organization leaders need to give up rigid control of these systems from above. Far more can be learned by stepping back from the day-to-day running of the organization and watching for emergent properties and organizational patterns. Those conditions or patterns that bring about the best solutions should be preserved whenever possible. Managers also need to allow organizations to evolve in response to ongoing messages from customers. As Hout states:

> No intelligence from on high can match the quality of solutions to market problems that arise from players who are constantly communicating with one another on the ground level. The invisible hand of the marketplace should displace the visible hand of the manager. The markets can determine where one team or initiative or company ends and another begins. Managers interfere at their peril.

Efforts to downplay management, as related by Hout, claim that "management as we have known it is too cumbersome for today's fast, unpredictable pace. A new kind of company wins now. The best management models don't adapt to the new economy; they emerge from it. It's no longer the survival of the fittest; it's the arrival of the fittest." Even so, putting the ideas of complexity theory to work does not mean management need rest on its laurels. Hout asserts that organizations's leaders retain an obligation to formulate a guiding vision for the company, provide effective leadership, express and encourage strong values and organizational beliefs, and provide avenues for open communication. Managers need to manage the way that accident and law interact, knowing how and where to push to keep the system from neither descending into chaos nor becoming rigidly ordered.

Letting an organization self-organize does not negate the need for strategy. Rather, it means that organizational strategy should evolve based on feedback and change as it occurs. By establishing a corporate strategy first, an organization defines itself through conditions that were previously in place, and becomes non-adaptive to continuously-evolving market conditions. Sherman and Schultz recommend the "try something and see what happens" mentality.

## CONTRARY BELIEFS

The idea that allowing complex systems to self-organize will yield the best solutions has validity, but complexity theory is not a panacea for all organizations. The notions of complexity theory assume that people in these companies are enthusiastic, intelligent, and can effectively work in teams—requiring less management than workers in more traditional, hierarchical, rigidly-controlled environments. Unfortunately, however, these fast-growing, evolutionary companies with bright, ambitious workers may need more management rather than less. Companies that are shaped and reshaped on such a frequent basis—constantly adapting to a changing business environment—lose some of the stability found at traditional corporate giants such as the industrial and automotive behemoths.

The modern corporation has a lot at stake. There are difficulties in teamwork and collaboration, with

potential issues such as nonperforming team members, personality conflicts, opposing business styles, and the effects of stress on job performance. Organizational leaders need to effectively manage personnel and job performance, reward and groom talented performers, develop business relationships and networks, resolve conflict, and divest the company of nonperformers who may be holding the company back from adapting well to emerging trends and technologies. Other business leaders see emergent strategy as a problem, rather than a cure. According to Alan Kay, head of research and development at Disney Imagineering, "Most businesses do not move so fast that foresight, commitment, preemption, deterrence, and other traditional elements of strategy have lost their ability to build value. The best way to predict the future is to invent it."

Complexity theory and the Santa Fe Institute represent common ground where scientists and theorists from disciplines such as economics, physics, business management, and computer science can research behavior of complex systems and their various components. The complexity paradigm also offers a means of applying modern theories that an organization is more like a living organism than a machine. Organizations are conceptualized as evolving in response to complex interactions within and without the system.

Ron Schultz, co-author of *Open Boundaries,* explains that complexity theory "is about how our ideas shape our behaviors. If our ideas about the world in which we operate are machine-like and mechanical, our behaviors will be very different than if our ideas are based on that of complex adaptive systems, which are more evolutionary and organic." Rather than following more linear approaches to corporate decision making, complexity theory offers organizations a way to thrive on the ambiguity and unpredictability that characterize modern business.

Some of complexity theory's leading experts, such as J. Doyne Farmer and Norman Packard, make a living advising companies and practically applying the ideas behind complexity theory to business areas such as corporate investment. Organizations putting the theory into practice include Xerox's Palo Alto Research Center (PARC), Applied Biosystems, and the United States Marine Corps. Complexity theory offers companies the opportunity to create new markets and establish new ways to spread emerging knowledge throughout the company—enabling the organization, as a whole, to respond faster and better to ongoing change.

*SEE ALSO:* Chaos Theory; Managing Change; Organizational Behavior; Trends in Organizational Change

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## COMPUTER-AIDED DESIGN AND MANUFACTURING

Computer-aided design (CAD), also known as computer-aided design and drafting (CADD), involves the entire spectrum of drawing with the aid of a computer—from straight lines to custom animation. In practice, CAD refers to software for the design of engineering and architectural solutions, complete with two- and three-dimensional modeling capabilities.

Computer-aided manufacturing (CAM) involves the use of computers to aid in any manufacturing process, including flexible manufacturing and robotics. Often outputs from CAD systems serve as inputs to CAM systems. When these two systems work in conjunction, the result is called CADCAM, and becomes part of a firm's computer-integrated manufacturing (CIM) process.

CADCAM systems are intended to assist in many, if not all, of the steps of a typical product life cycle. The product life cycle involves a design phase and an implementation phase. The design phase includes identifying the design needs and specifications; performing a feasibility study, design documentation, evaluation, analysis, and optimization; and completing the design itself. The implementation phase includes process planning, production planning, quality control, packaging, marketing, and shipping.

CAD systems can help with most of the design phase processes, while CAM systems can help with

most of the implementation processes. The contributions of CAD and CAM systems are described below.

## CAD SYSTEMS

CAD systems are a specialized form of graphics software, and thus must adhere to basic principles of graphics programming. All graphics programs work in the context of a graphics device (e.g., a window on a monitor, a printer, or a plotter). Graphics images are drawn in relation to a 2-D or 3-D coordinate system, of which there are several types.

A device coordinate system is 2-D and maps images directly to the points (pixels) of the hardware device. In order to facilitate device-independent graphics, a virtual device coordinate system abstracts the 2-D points into a logical framework.

Of course, the devices being designed are generally 3-D objects, which also require a world coordinate system for representing the space in which the objects reside, and a model coordinate system for representing each of the objects in that space. CAD software includes algorithms for projecting the 3-D models onto the 2-D device coordinate systems and vice versa.

CAD systems include several primitive drawing functions, including lines, polygons, circles and arcs, rectangles, and other simple shapes. From these primitives, 3-D composites can be constructed, and include cubes, pyramids, cones, wedges, cylinders, and spheres. These shapes can be drawn in any color, and filled with solid colors or other patterns (called hatching). In addition, basic shapes can be altered by filleting (rounding) or chamfering (line segmentation).

Based on the manipulation of basic shapes, designers construct models of objects. A skeletal wire form model is a 3-D representation that shows all edges and features as lines. A more realistic-looking model is called a solid model, which is a 3-D model of the object being designed as a unitary whole showing no hidden features. The solid model represents a closed volume. It includes surface information and data determining if the closed volume contains other objects or features.

Solid modeling involves functions for creating 3-D shapes, combining shapes (via union, intersection, and difference operations), sweeping (translational and rotational) for converting simple shapes into more complex ones, skinning (for creation of surface textures), and various boundary creation functions. Solid modeling also includes parameterization, in which the CAD system maintains a set of relationships between the components of an object so that changes can be propagated to following constructions.

Common shapes are constructed into features (e.g., slots, holes, pockets), which can then be included in a solid model of an object. Feature representation helps the user define parts. It also simplifies CAD software design because features are easier to parameterize than explicit interactions. Objects built from features are called parts. Since a product being designed is composed of several parts, many CAD systems include a useful assembly model, in which the parts are referenced and their geometric and functional relationships are stored.

CAD models can be manipulated and viewed in a wide variety of contexts. They can be viewed from any angle and perspective desired, broken apart or sliced, and even put through simulation tests to analyze for strengths and defects of design. Parts can be moved within their coordinate systems via rotation operations, which provide different perspectives of a part, and translation, which allows the part to move to different locations in the view space. In addition, CAD systems provide valuable dimensioning functionality, which assigns size values based on the designer's drawing.

The movement of these images is a form of animation. Often, CAD systems include virtual reality technology, which produces animated images that simulate a real-world interaction with the object being designed. For example, if the object is a building, the virtual reality system may allow you to visualize the scene as if you were walking around the inside and the outside of the building, enabling you to dynamically view the building from a multitude of perspectives. In order to produce realistic effects, the system must depict the expected effects of light reflecting on the surface as it moves through the user's view space. This process is called rendering.

Rendering technology includes facilities for shading, reflection, and ray tracing. This technique, which is also used in sophisticated video games, provides a realistic image of the object and often helps users make decisions prior to investing money in building construction. Some virtual reality interfaces involve more than just visual stimuli. In fact, they allow the designer to be completely immersed in the virtual environment, experiencing kinesthetic interaction with the designed device.

Some CAD systems go beyond assisting in parts design and actually include functionality for testing a product against stresses in the environment. Using a technique called finite element method (FEM), these systems determine stress, deformation, heat transfer, magnetic field distribution, fluid flow, and other continuous field problems.

Finite element analysis is not concerned with all design details, so instead of the complete solid model a mesh is used. Mesh generation involves computing a set of simple elements giving a good approximation of the designed part. A good meshing must result in an analytical model of sufficient precision for the FEM

computation, but with a minimum number of elements in order to avoid unnecessary complexity.

In addition to FEM, some CAD systems provide a variety of optimization techniques, including simulated annealing and genetic algorithms (borrowed from the field of artificial intelligence). These methods help to improve the shape, thickness, and other parameters of a designed object while satisfying user-defined constraints (e.g., allowable stress levels or cost limitations).

When a designer uses CAD to develop a product design, this data is stored into a CAD database. CAD systems allow for a design process in which objects are composed of sub-objects, which are composed of smaller components, and so on. Thus CAD databases tend to be object-oriented. Since CAD designs may need to be used in CAM systems, or shared with other CAD designers using a variety of software packages, most CAD packages ensure that their databases conform to one of the standard CAD data formats. One such standard, developed by the American National Standards Institute (ANSI), is called Initial Graphics Exchange Specification (IGES).

Another data format is DXF, which is used by the popular AutoCAD software and is becoming a de facto industry standard. The capability to convert from one file format to another is called data exchange, and is a common feature of many CAD software packages.

Modern CAD systems offer a number of advantages to designers and companies. For example, they enable users to save time, money, and other resources by automatically generating standard components of a design, allowing the reuse of previously designed components, and facilitating design modification. Such systems also provide for the verification of designs against specifications, the simulation and testing of designs, and the output of designs and engineering documentation directly to manufacturing facilities. While some designers complain that the limitations of CAD systems sometimes serve to curb their creativity, there is no doubt that they have become an indispensable tool in electrical, mechanical, and architectural design.

## CAM SYSTEMS

The manufacturing process includes process planning, production planning (involving tool procurement, materials ordering, and numerical control programming), production, quality control, packaging, marketing, and shipping. CAM systems assist in all but the last two steps of this process. In CAM systems, the computer interfaces directly or indirectly with the plant's production resources.

Process planning is a manufacturing function that establishes which processes and parameters are to be used, as well as the machines performing these processes. This often involves preparing detailed work instructions to machines for assembling or manufacturing parts. Computer-aided process planning (CAPP) systems help to automate the planning process by developing, based on the family classification of the part being produced, a sequence of operations required for producing this part (sometimes called a routing), together with text descriptions of the work to be done at each step in the sequence. Sometimes these process plans are constructed based on data from the CAD databases.

Process planning is a difficult scheduling problem. For a complex manufacturing procedure, there could be a huge number of possible permutations of tasks in a process requiring the use of sophisticated optimization methods to obtain the best process plan. Techniques such as genetic algorithms and heuristic search (based on artificial intelligence) are often employed to solve this problem.

The most common CAM application is numerical control (NC), in which programmed instructions control machine tools that grind, cut, mill, punch, or bend raw stock into finished products. Often the NC inputs specifications from a CAD database, together with additional information from the machine tool operator. A typical NC machine tool includes a machine control unit (MCU) and the machine tool itself. The MCU includes a data processing unit (DPU), which reads and decodes instructions from a part program, and a control loop unit (CLU), which converts the instructions into control signals and operates the drive mechanisms of the machine tool.

The part program is a set of statements that contain geometric information about the part and motion information about how the cutting tool should move with respect to the workpiece. Cutting speed, feed rate, and other information are also specified to meet the required part tolerances. Part programming is an entire technical discipline in itself, requiring a sophisticated programming language and coordinate system reference points. Sometimes parts programs can be generated automatically from CAD databases, where the geometric and functional specifications of the CAD design automatically translate into the parts program instructions.

Numerical control systems are evolving into a more sophisticated technology called rapid prototyping and manufacturing (RP&M). This technology involves three steps: forming cross sections of the objects to be manufactured, laying cross sections layer by layer, and combining the layers. This is a tool-less approach to manufacturing made possible by the availability of solid modeling CAD systems. RP&M is often used for

evaluating designs, verifying functional specifications, and reverse engineering.

Of course, machine control systems are often used in conjunction with robotics technology, making use of artificial intelligence and computer controlled humanoid physical capabilities (e.g., dexterity, movement, and vision). These "steel-collar workers" increase productivity and reduce costs by replacing human workers in repetitive, mundane, and hazardous environments.

CAM systems often include components for automating the quality control function. This involves evaluating product and process specifications, testing incoming materials and outgoing products, and testing the production process in progress. Quality control systems often measure the products that are coming off the assembly line to ensure that they are meeting the tolerance specifications established in the CAD databases. They produce exception reports for the assembly line managers when products are not meeting specifications.

In summary, CAM systems increase manufacturing efficiency by simplifying and automating production processes, improve the utilization of production facilities, reduce investment in production inventories, and ultimately improve customer service by drastically reducing out-of-stock situations.

## PUTTING IT ALL TOGETHER: COMPUTER INTEGRATED MANUFACTURING

In a CADCAM system, a part is designed on the computer (via CAD) then transmitted directly to the computer-driven machine tools that manufacture the part via CAM. Within this process, there will be many other computerized steps along the way. The entire realm of design, material handling, manufacturing, and packaging is often referred to as computer-integrated manufacturing (CIM).

CIM includes all aspects of CAD and CAM, as well as inventory management. To keep costs down, companies have a strong motivation to minimize stock volumes in their warehouses. Just-in-time (JIT) inventory policies are becoming the norm. To facilitate this, CIM includes material requirements planning (MRP) as part of its overall configuration. MRP systems help to plan the types and quantities of materials that will be needed for the manufacturing process. The merger of MRP with CAM's production scheduling and shop floor control is called manufacturing resource planning (MRPII). Thus, the merger of MRP with CADCAM systems integrates the production and the inventory control functions of an organization.

Today's industries cannot survive unless they can introduce new products with high quality, low cost, and short lead time. CADCAM systems apply computing technology to make these requirements a reality, and promise to exert a major influence on design, engineering, and manufacturing processes for the foreseeable future.

*SEE ALSO:* Computer-Integrated Manufacturing; Manufacturing Resources Planning; Robotics

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## COMPUTER-AIDED MANUFACTURING

*SEE:* Computer-Aided Design and Manufacturing

## COMPUTER-INTEGRATED MANUFACTURING

Computer-integrated manufacturing (CIM) is the use of computer techniques to integrate manufacturing activities. These activities encompass all functions necessary to translate customer needs into a final product. CIM starts with the development of a product concept that may exist in the marketing organization; includes product design and specification, usually the responsibility of an engineering organization; and extends through production into delivery and after-sales activities that reside in a field service or sales organization. Integration of these activities requires that accurate information be available when needed and in the format required by the person or group requesting the data. Data may come directly from the

originating source or through an intermediate database according to Jorgensen and Krause. CIM systems have emerged as a result of the developments in manufacturing and computer technology. According to Kusiak the computer plays an important role integrating the following functional areas of a CIM system:

- Part and product design. There are four phases that are crucial in part and product design. They include preliminary design, refinement, analysis, and implementation.
- Tool and fixture design. Tooling engineers using computer-aided design (CAD) tools to develop the systems or fixtures that produce the parts.
- Process planning. The process planner designs a plan that outlines the routes, operations, machines, and tools required. He or she also attempts to minimize cost, manufacturing time, and machine idle time while maximizing productivity and quality.
- Programming of numerically controlled machines and material handling systems.
- Production planning. There are two concepts used here including materials requirement planning (MRP) and machine loading and scheduling.
- Machining. This is part of the actual manufacturing process, including turning, drilling, and face milling for metal removal operations.
- Assembly. After they are manufactured, parts and subassemblies are put together with other parts to create a finished product or subassembly.
- Maintenance. Computers can monitor, intervene, and even correct machine malfunctions as well as quality issues within manufacturing.
- Quality control. This involves three steps including system design, parameter design, and tolerance design.
- Inspection. This stage determines if there have been errors and quality issues during the manufacturing of the product.
- Storage and retrieval. These tasks involve raw materials, work-in-process inventory, finished goods, and equipment.

## CIM ORIGIN

The term *computer-integrated manufacturing* was coined by Dr. Joseph Harrington in his 1974 book bearing that name. Until the 1970s, the most aggressive and successful automation was seen in production operations. Discrete parts manufacturing used highly mechanized machines that were driven and controlled by cams and complex devices such as automatic screw machines. Process manufacturers made use of these cam-driven controllers and limit switches for operations such as heat treating, filling and canning, bottling, and weaving states Robert Thacker of the Society of Manufacturing Engineers. The historical approach to automation focused on individual activities that result in the incorporation of large amounts of computerized activities. In the 1980s, managing information became an important issue.

## CIM BENEFITS

According to the U.S. National Research Council, CIM improves production productivity by 40 to 70 percent, as well as enhances engineering productivity and quality. CIM can also decrease design costs by 15 to 30 percent, reduce overall lead time by 20 to 60 percent, and cut work-in-process inventory by 30 to 60 percent. Managers who use CIM believe that there is a direct relationship between the efficiency of information management and the efficiency and the overall effectiveness of the manufacturing enterprise. Thacker's view is that many CIM programs focus attention on the efficiency of information management and the problems that come with it instead of developing new and more sophisticated manufacturing machines, material transformation processes, manufacturing management processes, and production facilities. Computer-integrated manufacturing can be applied to nonmanufacturing organizations by changing the manufacturing focus toward a service orientation. CIM and Job Definition Format (JDF) are becoming increasingly beneficial to printing companies to streamline their production process.

## THE CIM PLAN

A plan for a CIM system should provide a description of projects for automating activities, assisting activities with technology, and integrating the information flows among these activities. The planning process includes six crucial steps:

- project activation
- business assessment
- business modeling
- needs analysis
- conceptual design
- CIM plan consolidation and economic analysis

This process, according to Jorgensen and Krause, also acts as a building block for the future of the

organization integrating these functions in order to diminish them as an impediment to integration.

## CONCEPTUAL DESIGN

The conceptual design of a CIM environment consists of individual systems that fulfill the required capabilities, an overall architecture incorporating the systems and the communication links, and a migration path from the current systems architecture. Functional requirements must be compared to the current inventory of systems and available technology to determine system availability. Jorgensen and Krause state that the following techniques are used in satisfying system requirements:

- exploiting unused and available functional capabilities of current systems;
- identifying functional capabilities available for, but not installed on, current in-house systems;
- locating systems that are commercially available but not currently in-house;
- recognizing state-of-the-art technology that is not immediately commercially available on a system;
- foreseeing functional capabilities of systems on the technical horizon; and
- determining whether the requirement is beyond the capabilities of systems on the technical horizon.

## MANAGING A CIM

Managers must understand that short-term goals must support the long-term goal of implementing a CIM. Top management establishes long-term goals for the company and envisions the general direction of the company. The middle management then creates objectives to achieve this goal. Upper management sees the focus as being very broad, whereas middle management must have a more narrow focus.

In deciding to implement a CIM, there are three perspectives that must be considered: the conceptual plan, the logical plan, and the physical plan. The conceptual plan is used to demonstrate a knowledgeable understanding of the elements of CIM and how they are related and managed. Thacker goes on to say that the conceptual plan states that by integrating the elements of a business, a manager will produce results better and faster than those same elements working independently.

The logical plan organizes the functional elements and logically demonstrates the relationships and dependencies between the elements. Thacker details that it further shows how to plan and control the business, how to develop and connect an application, communications, and database network.

The physical plan contains the actual requirements for setting the CIM system in place. These requirements can include equipment such as hardware, software, and work cells. The plan is a layout of where the computers, work stations, robots, applications, and databases are located in order to optimize their use within the CIM and within the company. According to Thacker, sooner or later it becomes the CIM implementation plan for the enterprise.

CIM is challenged by technical and cultural boundaries. The technical challenge is first complicated by the varying applications involved. Thacker claims that it is also complicated by the number of vendors that the CIM serves as well as incompatibility problems among systems and lack of standards for data storage, formatting, and communications. Companies must also have people who are well-trained in the various aspects of CIM. They must be able to understand the applications, technology, and communications and integration requirements of the technology.

CIM cultural problems begin within the division of functional units within the company such as engineering design, manufacturing engineering, process planning, marketing, finance, operations, information systems, materials control, field service, distribution, quality, and production planning. CIM requires these functional units to act as whole and not separate entities. The planning process represents a significant commitment by the company implementing it. Although the costs of implementing the environment are substantial, the benefits once the system is in place greatly outweigh the costs. The implementation process should ensure that there is a common goal and a common understanding of the company's objectives and that the priority functions are being accomplished by all areas of the company according to Jorgensen and Krause.

*SEE ALSO:* Computer-Aided Design and Manufacturing; Flexible Manufacturing; Management Information Systems; Robotics

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*Revised by Hal Kirkwood, Jr.*

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## COMPUTER NETWORKS

For most businesses in the United States, computers are an essential part of their daily operations. Many businesses have come to rely on their computers to store and track information, communicate with customers and suppliers, design and manufacture products, and more. It is not uncommon for businesses of all sizes to have multiple computers in an office. Often, these computers are connected through networks that allow information to be shared between computers.

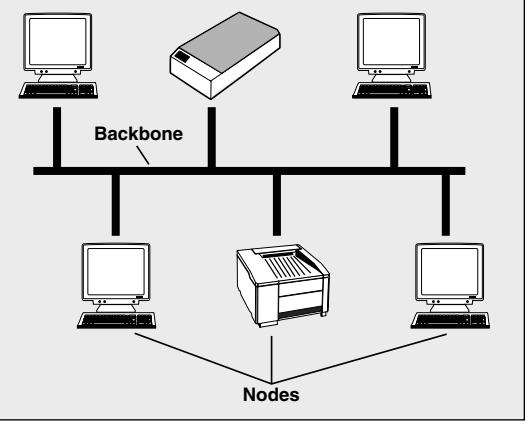
A computer network, as defined in the Merriam-Webster dictionary, is "a system of computers, peripherals, terminals, and databases connected by communications lines." In other words, networks are used to connect computers to other computers, as well as to other devices such as printers, scanners, and fax machines. Networks can be used to connect devices in the same building or they can be used to connect devices that are miles apart. Perhaps the most well known network in use today is the Internet. Many individuals and businesses around the world connect to the Internet on a daily basis. Other examples of networks include library card catalogs, the displays of flight arrival and departure times used at airports, and credit card readers at retail stores.

### NETWORK CONFIGURATIONS

Networks can be set up in a number of different ways depending on the number of devices, the distances between those devices, the transmission speed requirements, and other factors. The most popular configurations, or topologies, include the bus, token ring, star, and star bus topologies.

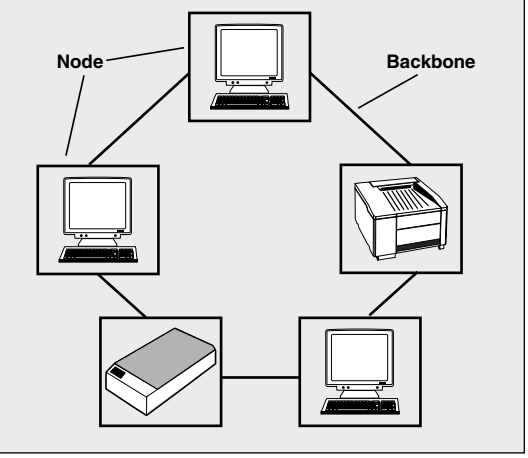
**BUS.** With a bus configuration, each node is connected sequentially along the network backbone. A node is any device connected to the network, such as a computer, printer, or scanner. Backbone is the term used to describe the main cables to which the network segments are connected. Resistors are placed at each end of the network to ensure that the signal is terminated when it reaches the end. When one node sends information to another node through the network, the information travels along the backbone until it reaches the desired receiving node.

**Figure 1**
**A Bus Topology**



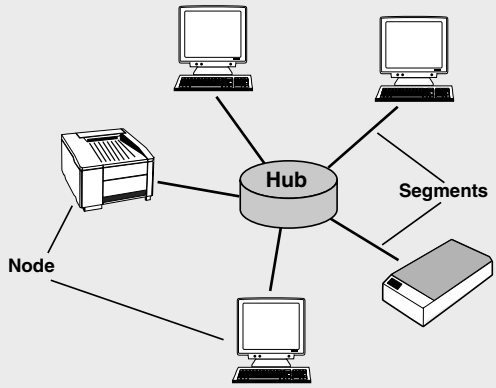

**TOKEN RING.** With a ring configuration, each node is connected sequentially along the network backbone. However, unlike the bus configuration, the end of the network connects to the first node, forming a circuit. Nodes on a token ring take turns sending and receiving information. In the token ring topology, a token travels along the backbone with the information being sent. The node with the token sends information to the next node along the backbone. The receiving node reads the information addressed to it and then passes the token and any additional information to the next node. This continues until the token and data make it back to the first node in the network.

**Figure 2**
**A Token Ring Topology**



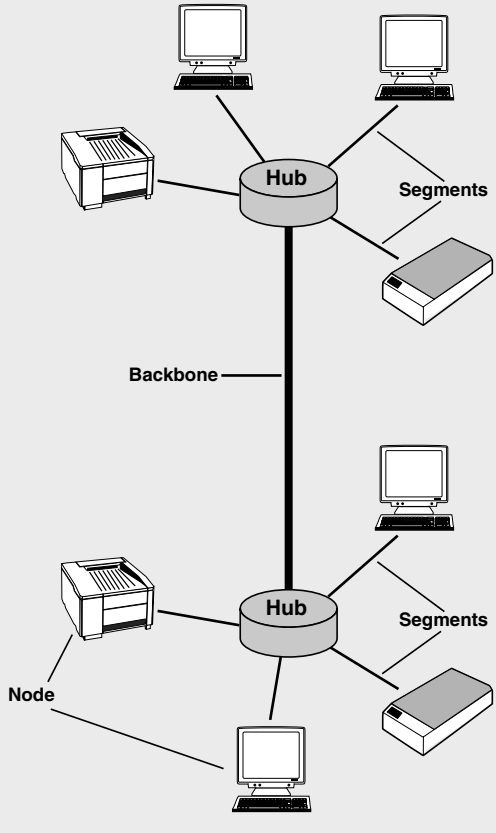

**STAR.** With a star configuration, each node is connected to a central hub via network segments. When one node sends information to another node, the information passes through the hub. The hub does not filter or route the information in any way; it simply serves as a connector between network segments.

**Figure 3**
**A Star Topology**




**STAR BUS.** With a star bus configuration, the hubs of multiple star networks are connected together via the backbone. This is the most common network configuration in use.

**Figure 4**
**A Star Bus Topology**




## LOCAL AREA NETWORKS AND WIDE AREA NETWORKS

A local area network (LAN), as the name implies, is a network that connects devices that are local, or relatively close to each other. Nodes on a LAN are usually in the same building. A wide area network (WAN), on the other hand, is used to connect nodes that could be miles apart. LANs generally transmit data faster than WANs, and they are usually more reliable. Fiber-optic cables are used for both LANs and WANs.

**ETHERNET NETWORKING.** Ethernet is a LAN protocol (i.e., a set of rules that governs communications) developed in the mid-1970s by Bob Metcalfe and David Boggs at Xerox Corporation's Palo Alto Research Center. Today, Ethernet is the most widely used network technology in the world. The original Ethernet used a bus topology and provided for transfer rates of up to 10 million bits per second (Mbps). This Ethernet specification was modified slightly and became the Institute of Electrical and Electronics Engineering (IEEE) 802.3 standard, which helped solidify Ethernet as a widely-recognized, open international standard. The IEEE 802.3 specifies the physical networking interface and lower layers of software usually associated with Ethernet. Vendors ship an estimated total of 300 million Ethernet ports each year.

Although networks using Ethernet protocol generally connect devices over short distances, technological advances now allow Ethernet to connect devices that are miles apart. Ethernet is widely accepted and largely installed because it is simple and efficient and because network interface cards (NIC) for Ethernet can be easily installed in personal computers, workstations, or high-end computers. Furthermore, it can run on a variety of media, including fiber optics, twisted-pair, cable, and wireless connections.

**REPEATERS.** When Ethernet was first implemented, most people used a copper coaxial cable. However, the maximum length of this cable was 500 meters, which was not long enough for some networks. To address this problem, network engineers used repeaters to connect several Ethernet segments.

**BRIDGES.** Bridges provide a simple means for connecting LANs. A bridge is a device that connects physically separate LAN segments (such as different Ethernet cables) into one logical LAN segment. There are four categories of bridges: transparent, source routing, encapsulating, and translating. Transparent bridges are used for Ethernet, whereas source routing bridges are used for token ring networks. Encapsulating bridges connect two segments of the same media (such as token ring to token ring) over a medium. The receiving bridge removes the envelope, checks the destination, and sends the frame to the destination device. Translating bridges are used to connect different types

of network media such as Ethernet and FDDI (fiber distributed data interface). FDDI is a set of protocols that uses a modified form of the token-passing method over fiber-optic cable.

**ROUTERS.** LAN segments joined by a router are physically and logically separate networks. In contrast to a bridge, when multiple network segments are joined by a router they maintain their separate logical identities (network address space), but constitute an internetwork.

Routers specify the destination and route for each packet, and they can be used to direct packets and interconnect a variety of network architectures. A major difference between a bridge and a router is that the bridge distinguishes packets by source and destination address, whereas a router can also distinguish packets by protocol type. Routers provide for the interfaces to WANs such as frame relay and packet switching services. Some new bridge products have added router capabilities; hence, the practical distinction is becoming blurred, giving rise to the term "brouter."

Routers can also be used to limit access to a network by the type of application (e.g., allowing electronic mail to pass, but not file transfer traffic). This capability provides a measure of security for the network, and is used extensively when creating firewalls. Firewalls are implemented to secure an organization's network when it is linked to the Internet.

**SWITCHES.** Ethernet communicates across the network using the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) process. A protocol using CSMA/CD monitors, or listens to, the media for network traffic, or information traveling through the network from one node to another. If a node does not sense any traffic, it will send frames or packets of information onto the media. A network frame is like a mailed letter. The letter is put in an envelope that has a return address and the address of its destination. Data are like the letter and the frame is like the envelope. The data is placed in the frame and the frame has the addressing information and error-checking code. Each protocol has its distinctive frame. The device continues sending until it finishes or until a collision occurs.

A collision happens when more than one device transmits data at the same time. When a collision occurs, each device waits a random amount of time before trying to retransmit the data. By having each node wait a random amount of time, there is only a slim chance that the two devices will send out the data at the same time again. The collision detection and frame retransmission are part of the protocol.

One way to reduce the number of collisions is to add switches to the network. A switch, like a hub, connects nodes to each other. However, while a hub requires each node to share the bandwidth (i.e., the amount of simultaneous data traffic the network can support), a switch allows each node to use the full bandwidth.

In a fully switched network, each node is connected to a dedicated segment of the network, which in turn is connected to a switch. Each switch supports multiple dedicated segments. When a node sends a signal, the switch picks it up and sends it through the appropriate segment to the receiving node. Ethernet protocol in a fully switched environment does not require collision detection because the switches can send and receive data simultaneously, thus eliminating the chance of collision.

Most companies do not use fully switched networks, as the cost of replacing each hub with a switch can be expensive. Instead, most use a mixed network configuration in which a combination of hubs and switches are used. For example, all of the computers in each department may be connected to their own departmental hub, and then all of the departmental hubs may be connected to a switch.

## ETHERNET ADVANCEMENTS

The dominance of Ethernet as a LAN technology for desktop PCs has made it difficult for other technologies to gain acceptance. Ethernet technology continues to evolve as Ethernet vendors develop techniques to increase bandwidth and the support of more complex network configurations. For example, Fast Ethernet technology was developed to provide for increased bandwidth of up to 100 Mbps, ten times faster than the original Ethernet. When migrating from Ethernet to Fast Ethernet, a company may need to change network interface cards and the central wiring hub, and it may also need to upgrade the wiring.

In May 1996 eleven network vendors (including Cisco Systems and Sun Microsystems) formed the Gigabit Ethernet Alliance. The goal of the alliance was to develop a standard for 1 Gigabit per second (Gbps) Ethernet transmissions. Soon thereafter, network vendors were successful in designing networks that achieved the 1 Gbps transmissions goal, and in 2002 the IEEE approved the fibre-only 10 Gbps Ethernet. Throughout 2004 great progress was made in the development of l0 Gbps Ethernet technology and its infrastructure. The increased speed of the 10 Gbps Ethernet in terms of data storage, system backup, teleconferencing, and surveillance systems will prove beneficial to blade servers, networked enterprise switches, video servers, and other applications. The higher density, reduced power, and improved cost-effectiveness appeal to all of the major system developers.

Another development in Ethernet technology is power over Ethernet (POE), which the IEEE published in July 2003 as the 802.3af standard. PowerDsine

**Table 1**
**Common Line Designations**

| Line Designation | Speed | Equivalents |
|---|---|---|
| DS0 (Digital Signal Zero) | 64 Kbps | |
| ISDN | 16 Kbps or 128 Kbps | Two DS0 lines plus signaling |
| T1 | 1.544 Mbps | 24 DS0 lines |
| T3 | 43.232 Mbps | 28 T1 lines |
| OC3 (Optical Carrier 3) | 155 Mbps | 84 T1 lines |
| OC12 | 622 Mbps | 4 OC3 lines |
| OC48 | 2.5 Gbps | 4 OC12 lines |
| OC192 | 9.6 Gbps | 4 OC48 lines |

Adapted from "How does a T1 line work?" How Stuff Works, Inc., 2005. Available from http://computer.howstuffworks.com/question372.htm

came up with the idea for POE in 1998 and convinced 3Com, Intel, Mitel, National Semiconductor, and Nortel Networks to promote this technology. One of the main purposes of POE is to standardize connections to portable and remote devices that no longer need AC line power. POE can be used for a number of applications, including digital cameras, security systems, and smart sensors.

## NETWORK REMOTE ACCESS DEVICES

Network remote access devices are used to connect remote (off-site) users to an organization's network. There are many options available. See Table 1 for some of the common line designations.

**MODEMS.** A modem is a device that converts data from digital to analog signals so it can travel over the public switched telephone network (PSTN) to its destination. Once the signal reaches its destination, the modem converts it back to digital. As the PSTN was designed to carry voice (analog signals), it is not the best option for carrying data. Digital data networks (DDNs) are replacing the PSTN. DDNs are used to transmit both data and digitized voice. Because of their slow data transmission speeds, modems are no longer used in most business environments.

**ISDN.** Integrated services digital network (ISDN) is a switched, high-speed data service. ISDN is an international telecommunications standard for transmitting voice, video, and data over digital lines running at 64 Kbps, and reaches 1.5 Mbps in North America and 2 Mbps in Europe. ISDN uses the same copper telephone lines as modems do, but at a rate approximately five times faster. Furthermore, it is extremely reliable.

**T1.** A T1 line carries data approximately 60 times faster than a modem on a normal telephone line. The higher speed and extreme reliability make this a popular choice for many medium- to large-sized businesses. T1 lines can handle hundreds of users simultaneously for general browsing. However, it cannot handle that many users simultaneously downloading large files, such as MP3 files or video files. For very large companies, T1 lines may not be sufficient.

**CABLE MODEMS.** A cable modem is a device used to connect a computer to a coaxial cable, such as the kind used for cable television, in order to access online services. This device modulates and demodulates signals like a conventional modem. In addition, a cable modem functions like a router designed for installation on cable television networks. The most popular application for cable modems is high-speed Internet access, which provides much faster service than standard telephone-line modems, thus enabling users to access streaming audio, video, and other services.

**WIRELESS TECHNOLOGY.** Mobile telephones, laptop computers, and handheld computers are so affordable that they have become a part of everyday life for many people and businesses around the world. Advances in wireless technology have made it possible for people to access networks without having to physically connect to the network through cables. For example, it is not uncommon for business travelers to access networks on their wireless fidelity (Wi-Fi)-enabled laptop PCs or handheld computers while waiting at an airport.

Bluetooth is a wireless standard developed by a group of electronics manufacturers to allow any electronic device—such as computers, cell phones, keyboards, and headphones—to find and connect to other devices without any direct action from the user. The devices find one another and transmit data without any user input at all. Because Bluetooth technology is inexpensive and does not require the user to do anything special to make it work, it is gaining wide use around the world.

Wireless products are now affordable and very reliable. With wireless connections, it is possible for people to move around while connected to a network. This could be very useful in environments such as hospitals, so that health care professionals could access patient records from various locations around the campus. Many home and small-business users also use wireless networks to avoid the need to route twisted-pair wiring around their premises. In fact, domestic, small-office, and home-office networking accounts for most of the wireless Ethernet equipment sales in the United States.

In summary, computers connected with communications networks improve productivity and profitability by enabling people and organizations to develop closer relationships with coworkers, customers, business partners, and other people in general.

*SEE ALSO:* Computer Security; The Internet

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## COMPUTER SECURITY

Computers have become such a big part of everyday life—both at work and at home—for many people around the world. These days, computers are an essential part of practically every type of business, from small, home-based businesses to large multinational corporations. In the business world, companies use computers to store information, design and manufacture products, run complex calculations, etc. On a personal level, many people rely on their home computers to store important information, watch movies, play games, communicate with others, and shop over the Internet.

Because so much valuable information is stored on computers, a new type of criminal has emerged in recent years. These criminals, sometimes called "hackers" or "scammers," use their computers to "break in" to companies' or other people's computers to steal information, such as credit card numbers. The incidence of identity theft is on the rise as computer criminals find increasingly sophisticated ways to obtain personal information and use it in malicious ways. However, not all hackers are interested in stealing information. Instead, some send viruses through websites or email to damage the receivers' computers.

### RECORDS PROTECTION

Information stored in a computer system is subject to a variety of threats. It was not long ago that the biggest concern about computer data was protecting it from physical disasters such as floods and fires, technology failures, and human errors. Most organizations develop contingency plans whereby they examine the possibilities of losing computer operations, and formulate procedures for minimizing damage. A disaster recovery plan is typically adopted to outline how the organization will carry on business in the event of a catastrophic loss. Data backup is an essential element of disaster recovery and involves the regular, systematic backing up of data to media that may include floppy disks, removable hard disks, CD-ROMs, or magnetic tape. Ideally, the backup files are then stored in a safe that is fireproof, heatproof, waterproof, and preferably protected at an off-premise location.

While the threat to computer files from disasters is real, research shows that employees are frequent culprits in the destruction or alteration of company information. Customer information, new-product plans, company financial information, and legal information can be stolen and sold to other organizations. Former or disgruntled workers who want revenge on their employer or supervisor have been known to resort to computer crime. The victim of information

theft rarely learns of the problem until afterward, since copying information does not alter the original in any way. For this reason, prosecution is rare and frequently results in mild treatment. In some cases, perpetrators have taken new jobs as security consultants after receiving minor punishments.

Although records protection is still of concern today, there are many more concerns about the safety of computer data, both at work and at home. Because so much business is now conducted over the Internet, computer criminals have discovered ways to steal that information. Terms such as spyware, phishing, pharming, viruses, firewalls, and spam are practically household words among computer users, especially those who use the Internet.

## SPYWARE

Spyware is a term used to describe a program that is put on a computer without the user's permission, and usually without the user's knowledge. A spyware program runs in the background and keeps track of the programs the user runs and the websites the user visits. Some spyware tracks the user's keystrokes and extracts passwords and other information as they type. It then uses the information gathered to display certain advertisements or forces the user's browser to display certain websites or search results. Most spyware is written for the Windows operating system.

Spyware can be installed on an unsuspecting user's computer in any of the following ways:

- Piggybacked software installation: Some software applications install spyware as part of the program installation. This is especially true of "free" software that users download onto their computers.
- Drive-by download: Some websites automatically try to download and install spyware on the user's machine. Sometimes when this happens, the user's browser may display a standard popup message that tells the name of the software and asks if the user wants to install it. But if the user's security setting is low enough, his browser may not display the message.
- Browser add-ons: This type of spyware adds enhancements, such as a toolbar, an animated pal, or additional search boxes, to the user's web browser. While the user may like these enhancements, some of them embed themselves deep in the user's computer and are very hard to remove from the computer. These embedded spyware programs are also known as browser hijackers.
- Masquerading as anti-spyware: Some spyware claim to be anti-spyware software, but in reality are spyware programs themselves. They trick users into thinking that they remove spyware, when they actually install additional spyware of their own.

Not only does spyware infringe upon users' privacy, but it can also slow down their computers. Many spyware programs use up most of the computer's random access memory (RAM) and processor power, preventing other applications from using these resources. In addition, many spyware programs generate popup advertisements that slow down the user's web browser, reset the user's homepage to display advertisements every time she opens the web browser, and redirect the user's web searches. Some spyware programs even modify the user's Internet settings for modem connections to dial out to expensive, pay telephone numbers. Some of the more malicious spyware programs modify the user's firewall settings, increasing the opportunities for more spyware and viruses to enter the user's computer.

Spyware has become such a problem that many states are taking action to explicitly ban spyware. Several federal laws deal with spyware. These include the Computer Fraud and Abuse Act, which covers any unauthorized software installations; The Federal Trade Commission Act, which deals with deceptive trade practices; and the Electronic Communications Privacy Act, which makes it illegal for companies to violate the security of customers' personal information. Unfortunately, these laws are very hard to enforce.

## PHISHING

Phishing is a term used to describe email scams that attempt to trick consumers into disclosing personal and/or financial information. The email messages appear to be from legitimate sources, such as banks, credit card issuers, or well-known Internet sites (such as America Online, Paypal, and eBay). The content of the messages varies, but often they tell the consumer that he needs to update personal information or that there is a problem with the consumer's account. The messages usually contain links to fake websites. When the user clicks the link, they are taken to websites that look official, and may even include images from the legitimate websites. These fake websites often instruct the unsuspecting user to enter credit card numbers, social security numbers, bank personal identification numbers (PINs), and other valuable information. Once the user enters that information, the violators use it or sell it. This leads to what is known as identity theft. The scammers use this information to assume the identity of the victims to make purchases in that person's name.

It is estimated that between July and October of 2004, the number of new phishing websites grew approximately 25 percent per month. The amount of money that phishers collected from victims in a twelve-month period (April 2003 through April 2004) is estimated to be $1.2 billion.

In an effort to stop phishing, U.S. Senator Patrick Leahy introduced the Anti-Phishing Act of 2005, which allows law enforcement officials to prosecute scammers before the actual fraud takes place. The bill also addresses pharming, which occurs when scammers redirect a user's browser to a fake banking or e-commerce site that asks for personal information. According to Leahy, "Some phishers and pharmers can be prosecuted under wire fraud or identity theft statutes, but often these prosecutions take place only when someone has been defrauded. For most of these criminals, that leaves plenty of time to cover their tracks. Moreover, the mere threat of these attacks undermines everyone's confidence in the Internet. When people cannot trust that websites are what they appear to be, they will not use the Internet for their secure transactions."

In December 2004 several financial institutions, Internet service providers (ISPs), online auctions, IT vendors, and law enforcement agencies came together to form an anti-phishing consortium. This group, called the Digital PhishNet group, includes big names such as Microsoft Corp.; America Online, Inc.; VeriSign, Inc.; EarthLink, Inc.; the Federal Bureau of Investigation (FBI); the Federal Trade Commission; and the U.S. Secret Service; the U.S. Postal Inspection Service. According to the consortium's website (<http://www.digitalphishnet.org>), it is a "joint enforcement initiative between industry and law enforcement" designed to catch phishing perpertrators.

The Anti-Phishing Working Group (APWG) also formed in response to the growing number of phishing complaints. According to the APWG website (<http://www.antiphishing.org>), the group is "the global pan-industrial and law enforcement association focused on eliminating the fraud and identity theft that result from phishing, pharming and email spoofing of all types." The APWG has more than 1,200 members, including nearly 800 companies and agencies, eight of the top ten U.S. banks, four of the top five U.S. Internet service providers, hundreds of technology vendors, and national and provincial law enforcement agencies worldwide.

## SPAM

Spam is a term used to describe unsolicited email messages that usually contain an advertisement for some product or service, such as mortgage loans, pornography, or prescription drugs. Spammers send the messages to email addresses on wide-scale mailing lists, which could mean that each message is sent to thousands of people. Spam has become such an annoying problem for so many people that software programmers have developed spam filters to block or delete some email messages before they reach the recipient's email account. Most ISPs offer some level of spam filtering to their customers. However, even with these filters, hundreds of spam messages get through.

Practically everyone with a public email address receives spam every day. According to *BusinessWeek* Online (June 10, 2003), "in a single day in May [2003], No. 1 Internet service provider AOL Time Warner (AOL) blocked 2 billion spam messages—88 per subscriber—from hitting its customers' e-mail accounts. Microsoft, which operates No. 2 Internet service provider MSN plus e-mailbox service Hotmail, says it blocks an average of 2.4 billion spams per day."

Where do spammers get email addresses? Hundreds of companies compile lists of email address and put them on CDs, which they sell to anyone who is willing to pay for them. Each CD can contain millions of email addresses. These companies use programs to pull out screen names and email addresses from newsgroups and chat rooms or the Internet itself. Some spammers use spambots, which are programs that go through the web and look for the @ symbol and pull the email addresses associated with each one. Another method spammers use to obtain email addresses is to create websites specifically designed to attract web surfers. These websites may ask you to enter your email address to see what the site has to offer (for example, large amounts of money).

And finally, perhaps the most common method spammers use to get email addresses is to conduct a dictionary search of the mail servers and large ISPs. Dictionary searches use a program that establishes a connection with the target mail server and then submits millions of random email addresses. Often they will vary these email addresses very slightly (such as by adding a number somewhere in the address). The program then collects the email addresses for which the message actually goes through.

There are hundreds of companies around the world that have formed specifically to cater to spammers. They offer services for sending bulk email. Some of the larger companies can send billions of messages a day. Many of these companies are set up outside the United States to avoid U.S. laws. Some claim to be "spam free." This means that the email addresses they use are taken from the list of users who requested to receive bulk email, or "opt-in" email. A user's email address can be placed on an opt-in list when ordering something online. Many online stores include a checkbox near the bottom of the order page

that asks the user to clear the checkbox if they do not want to receive email offers from their partners. If a user does not see that or misinterprets the checkbox, they may be placed on an opt-in list.

As mentioned above, there are many different spam filtering software programs on the market. These filters check email as it arrives in the user's electronic mailbox. The user can set up the filter to check for specific words or specific email addresses or specific types of attachments. If the filter detects any of these, it will either delete the message or place it in a separate folder. Unfortunately, spammers often find ways around these filters. Another problem with filters is that they sometimes filter out legitimate messages.

In 1998, Spamhaus.org was formed to track and stop spammers around the world. Australian-based Spamhaus (<http://www.spamhaus.org>) calls itself "an international non-profit organization whose mission is to track the Internet's Spam Gangs." Spamhaus.org also says it seeks to provide "dependable realtime anti-spam protection," works with law enforcement agencies to "identify and pursue spammers worldwide," and lobbies for "effective anti-spam legislation."

Today, Spamhaus continues to fight spam. The group publishes the Register Of Known Spam Operations (ROKSO), which lists the Internet Protocol (IP) addresses of the 200 worst spam gangs worldwide. ISPs can use this list to avoid signing up known spammers, and Law Enforcement Agencies can use the list to help target and prosecute spam gangs. Spamhaus also publishes two spam-blocking databases—the Spamhaus Block List (SBL) and the Exploits Block List (XBL).

## VIRUSES

Computer viruses are programs that spread from one computer to another, causing problems on each computer it touches. As viruses propagate, they use up so much memory that it can slow down computer systems to the point that they are unusable. Some viruses actually attack files on the computer by deleting them or modifying them in some way that renders the computer unusable.

The extent of damage caused by a virus varies. Some affect a relatively small number of computers. Others have been so devastating that they can even cripple large companies. For example, in March 1999, when the Melissa virus hit, it was so destructive that it forced Microsoft and other large companies to completely shut down their email systems until the virus could be contained.

There are four general types of computer viruses:

1. Viruses. These are small programs that attach themselves to other programs. When a user runs the legitimate program, the virus program runs, too. Once on a computer, some viruses find other vulnerable programs and attach to them as well, causing even more damage. The virus spreads to other computers when the unknowing user shares or passes on an infected program via CD, for example.
2. Email viruses. These are viruses that are transmitted via email. When users open an email message or an email attachment containing a virus, they release it onto their computers. Some email viruses replicate themselves by emailing themselves to people listed in a victim's email address book.
3. Worms. These are small programs that usually take advantage of networks and spread to all computers on the network. Worms scan networks for computers with security holes in programs or operating systems, replicate themselves on those computers, and then start all over from there. Because worms usually spread through networks, they can affect multiple computers in a very short amount of time. The Slammer worm, released in January 2003, spread more rapidly than any other virus before it. Within 15 minutes, it had shut down cell phone and Internet service for millions of people around the world.
4. Trojan horses. These are computer programs that claim to be one thing but are actually viruses that damage the computer when the user runs it. Trojan horses cannot replicate automatically.

Because viruses have the potential to wreak havoc on computer networks and individual computers, many virus-protection products have been developed to prevent this. Most virus-protection software scans the computer when it is first turned on and looks for known viruses. As new viruses are discovered, virus protection providers have to update their virus definitions.

## FIREWALLS

A firewall is basically a barrier that prevents damaging files or programs from reaching the user's computer. Many operating systems now include a built-in firewall. There are also many after-market firewall products available for purchase. Firewalls filter the data that comes through an Internet connection. If the firewall detects any suspicious information, it does not allow that information through. Most companies and many individuals who have Internet access use firewalls to protect their computers and networks. Although

some firewalls protect against computer viruses, many experts recommend that companies and individuals invest in a separate anti-virus software package.

Firewalls control the flow of network traffic using one or more of the following methods:

- Packet filtering: The term "packet" is used to describe a small group of data. With the packet filtering method, a firewall compares the packets of incoming and outgoing data against a set of specific rules. If the packets meet the acceptable criteria, the firewall lets the data through. Any data that does not make it through the firewall is discarded.
- Proxy service: Proxy servers are used to access web pages by other computers. When a computer requests a web page, the proxy server retrieves the information and then sends it to the user's computer. With a proxy server, the computer hosting the website does not come into direct contact with the user's computer.
- Stateful inspection: This newer method compares only certain key parts of the packet to a database of trusted information. The firewall compares outgoing data against specific criteria and then compares incoming data against the same criteria. If the two comparisons match, the firewall lets the information through.

Several criteria that firewalls use to compare incoming and outgoing data are listed below:

- Internet Protocol (IP) addresses: Each computer on the Internet has a unique IP address, which consists of 32-bit numbers. If a firewall detects too many files being read by a certain IP address outside of the company, it may block all traffic to and from that IP address.
- Domain names: Each server on the Internet has its own domain name, which is the website address most people recognize (as opposed to the IP address). If a company knows that certain domain names are not "safe," they will set up the firewall to block access to that domain name. On the other hand, the company may set up the firewall to allow access to only certain domain names.
- Protocols: Protocol is a term used to describe the way a program communicates with a web browser. Some of the more common protocols include IP (Internet Protocol), which is the main delivery system for information over the Internet; TCP (Transmission Control Protocol), which breaks apart and rebuilds information from the Internet; HTTP (Hyper Text Transfer Protocol), which is used for web pages; FTP (File Transfer Protocol), which is used to download and upload files; and many more. A company may set up a firewall that allows only one or two machines to handle certain protocol and prohibit that protocol on all other machines.
- Specific words or phrases: Companies can set up firewalls to search for specific words or phrases. If the firewall encountered packets containing any of those words, it would not allow the packet through.

As more people buy computers and connect to the Internet, the number of potential computer theft victims grows. However, as users become more well-informed about the dangers that exist, they will take precautions to avoid becoming a victim. And as governments and law enforcement agencies around the world are learning more about these crimes and how to deal with them, they are taking action to prosecute the perpetrators.

*SEE ALSO:* Computer Networks; Technology Management

*Rhoda L. Wilburn*

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## CONCURRENT ENGINEERING

Concurrent engineering is a method by which several teams within an organization work simultaneously to develop new products and services. By engaging in multiple aspects of development concurrently, the amount of time involved in getting a new product

to the market is decreased significantly. In markets where customers value time compression, fast-cycle developers have a distinct advantage. Additionally, in many high-technology areas such as electronics and telecommunications, product-technology performance is continuously increasing and price levels are dropping almost daily. In such areas, a firm's ability to sustain its competitive edge largely depends on the timely introduction of new or improved products and technologies. More and more, the time parameter makes the difference between mere survival and substantial profit generation. Concurrent engineering is a key method for meeting this need of shortening a new product's time-to-market.

## SEQUENTIAL NEW PRODUCT DEVELOPMENT

In the past, commercial success was practically guaranteed for companies that could design, develop, and manufacture high-quality products that satisfied real needs at competitive prices. However, beginning in the early 1990s this traditional formula radically changed as time-to-market became a vital component of commercial success. Studies have demonstrated that being a few months late to market is much worse than having a 50 percent cost overrun when these overruns are related to financial performance over the lifecycle of a new product or service. In other words, time has become a key driver of competitive success, from design and development to the actual launch of a new product or service.

Traditional project planning and execution has been marked by the definition of objectives and milestones. These goals are met through a progression of networked activities, some of which must be performed sequentially, others of which may be conducted in parallel. Planning techniques such as Program Evaluation and Review Technique (PERT), Graphical Evaluation and Review Technique (GERT), and Critical Path Method (CPM) have been used to support this sequencing of tasks and activities. However, until the beginning of the 1990s time compression was not a major issue in the new product development environment. In the planning and scheduling of tasks and activities, any time compression concerns were only implicitly present.

## CONCURRENT NEW PRODUCT DEVELOPMENT

Because time has become a competitive weapon, time pressures have become central to the project-based new product development organization. These pressures have led to the explicit understanding that time compression is a driver of project (and subsequent business) performance. As a consequence, methods, techniques, and organizational approaches have been designed and developed that allow for time compression needs to be handled in a proper manner. All time-centered approaches have one principle in common: they attempt to maximize the number of major design or development tasks that are performed concurrently, thus the concept of concurrent engineering.

In a concurrent engineering environment, even if certain tasks cannot be completely executed at the same time, designers and developers are encouraged to achieve maximum overlap between otherwise sequential activities. In other words, concurrent engineering aims at achieving throughput time reductions by planning and executing design and development activities in parallel, or by striving for maximum overlap between activities that cannot be completely executed in parallel (for example, when one of the tasks or activities requires information to be partially generated during a previous task or activity).

Therefore, concurrent engineering is based on the premise that the parallel execution of major design components will decrease the throughput time of projects, thus reducing the time-to-market for new products and services. For example, applying concepts of parallelism during the Boeing 777 transport design resulted in a time compression of 1.5 years as compared to its predecessor, the Boeing 767. Concurrent engineering allowed the Boeing Company to introduce the new airplane in time to limit the advantage of its competitor, Airbus Industrie.

Many companies have benefited from this same approach. Firms like Intel and Canon have been among the leaders in shortening their product development cycles through the implementation of concurrent engineering. However, this trend has not been limited to individual companies; complete industry sectors also have implemented concurrent engineering principles. At the beginning of the 1990s, the automotive industry pioneered many of the concurrent engineering concepts and their implementation. By early 2000s, many industries, including electronics and pharmaceuticals, were behaving in much the same manner.

## IMPLEMENTING CONCURRENT ENGINEERING

In a concurrent engineering environment, teams of experts from different disciplines are formally encouraged to work together to ensure that design progresses smoothly and that all participants share the same, current information. The project and problem-solving methods and the technologies utilized make up the essential elements through which parallelism in new product design and development can be achieved. Following is a discussion of how each of these elements contributes to concurrent engineering implementation.

**PROJECT METHODS.** Project methods based on teamwork, milestone management, and target-oriented work definition and follow-up are paramount. These methods also must be supported by appropriate senior management commitment and incentive systems. Each team is granted a large degree of autonomy to solve design problems where and when they occur, without much hierarchical intervention. However management must ensure that the transfer of information between different activities or tasks is smooth and transparent. Also, the means of experimentation must allow the experts involved to rule out differences in interpretation on the functional and technical design parameters. In other words, for concurrent engineering to be successful, information and interpretation asymmetries between the experts involved must be avoided whenever possible.

**PROBLEM-SOLVING METHODS.** During design and development projects, methods are utilized that foster and support smooth interdisciplinary problem definition and problem solving. Methodologies such as brainstorming open the boundaries of the team to allow for wider ranges of alternative design definitions and solutions to be considered. The use of methodologies like Quality Function Deployment (QFD) further aids experts from different disciplinary backgrounds to jointly define a product's functional and technical requirements. Activity flow chart methods such as IDEF3 allow for detailed planning and monitoring of the different parallel and overlapping activities involved in project execution. Failure Mode and Effects Analysis (FMEA) allows for a systematic investigation of the occurrence and impact of possible flaws in the new product design. The use of Design of Experiments (DOE) enables the systematic identification of critical product/process parameters that influence performance. These are just a few of the many supportive methods that can be used in a concurrent engineering environment. The sources listed at the end of this essay provide more detailed and exhaustive overviews on these and other methodologies supporting concurrent engineering.

## TECHNOLOGIES

In concurrent engineering, design technologies are utilized that foster efficient cross-disciplinary analysis, experimentation, and representation of new product designs. Some examples of these technologies include: three-dimensional (3-D) computer-aided design (CAD) systems, rapid prototyping techniques, rapid tooling and rapid testing techniques, as well as techniques that enable the representation of product designs in a virtual context. These design technologies are important because of the key information they convey: their 3-D character allows the expert to interpret design features in a more effective and efficient way.

All of these technologies contribute to the reduction of interpretation asymmetries between the experts involved, as well as to fast-cycle design and development, because they allow for high-speed iterations of analysis and experimentation on both concepts and models of the product. Thus, they modify traditional project management approaches by allowing for more systematic and flexible experimentation and iteration to be included throughout the project's design and development process. In fact, the time and cost incurred by the development and construction of prototypes generally are reduced by factors of 2 to 5 when using digital (e.g., 3-D CAD) and physical (e.g., rapid prototyping) technologies. These tools have become an important enabling factor in the concurrent engineering environment. Without their implementation and further upgrading, concurrent engineering might never be able to realize its full potential in terms of design cost and lead-time optimization.

This brief overview has provided a summary of the why, what, and how involved in implementing a concurrent engineering philosophy for the development of new products, services, and processes. It has outlined how introducing overlap during the execution of innovation project tasks and activities has become vital because of competitive pressures that force new product developers to be more time-conscious.

However, a final caveat is warranted. Although concurrent engineering is an important method for handling the time pressures that occur during new product development, rushing products to the market can sometimes be a mistake. First, markets need time to develop. Numerous examples exist where a new product was too early for the market to absorb it or where product variety has reached limits beyond which the product choice decision becomes too complicated for customers. Second, more revolutionary new product development, which often is based on significant technological advances, typically requires longer time horizons to reach completion. Putting too much emphasis on time compression may blind an organization to this basic fact. Third, the conceptual development of new product ideas requires time or "slack." In a high-speed development organization, time-compression imperatives may undermine this need. Therefore, both managers and new product developers need to find a balance between the paradoxical needs for speed and slack in their organizations. Despite its efficiency, concurrent engineering will only prove to be effective when this balance is achieved through the experience and leadership of an organization's senior management.

*SEE ALSO:* New Product Development; Time-Based Competition

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## CONFLICT MANAGEMENT AND NEGOTIATION

The term conflict refers to perceived incompatibilities resulting typically from some form of interference or opposition. Conflict management, then, is the employment of strategies to correct these perceived differences in a positive manner. For many decades, managers had been taught to view conflict as a negative force. However, conflict may actually be either functional or dysfunctional. Whereas dysfunctional conflict is destructive and leads to decreased productivity, functional conflict may actually encourage greater work effort and help task performance. Borisoff and Victor (1998) point out, "We have come to recognize and to acknowledge the benefits dealing with conflict affords. Because of our differences, we communicate, we are challenged, and we are driven to find creative solutions to problems."

### THE EVOLUTION OF CONFLICT MANAGEMENT

The early approach to conflict management was based on the assumption that all conflict was bad and would always be counterproductive to organizational goals. Conflict management, therefore, was synonymous with conflict avoidance. This left the people experiencing the conflict with essentially only one outcome: a win-lose scenario. In such cases, the loser would feel slighted and this, in turn, would lead to renewed belligerence. Therefore, most managers viewed conflict as something they must eliminate from their organization. This avoidance approach to conflict management was prevalent during the latter part of the nineteenth century and continued until the mid-1940s.

Nevertheless, conflict avoidance is not a satisfactory strategy for dealing with most conflict. Conflict avoidance usually leaves those people who are being avoided feeling as if they are being neglected. Also, conflict avoidance usually fails to reconcile the perceived differences that originally caused the conflict. As a result, the original basis for the conflict continues unabated, held in check only temporarily until another confrontation arises to set the same unresolved tensions into motion again. Therefore, conflict avoidance strategies are not especially useful in the long run.

The human relations view of conflict management dominated from the late 1940s through the mid-1970s. This viewpoint argued that conflict was a natural and inevitable occurrence in any organizational setting. Because conflict was considered unavoidable, the human relations approach recommended acceptance of conflict. In other words, conflict cannot be eliminated and may even benefit the organization. It was during this time period that the term "conflict management" was introduced, according to Nurmi and Darling.

Since the mid-1970s a new position on organizational conflict has emerged. This theoretical perspective is the interactionist approach. This viewpoint espouses not only accepting conflict, but also encouraging it. Theorists are of the opinion that a conflict-free, harmonious, and cooperative organization tends to become stagnant and nonreponsive to market change and advancement. Therefore, it is necessary for managers to interject a minimum level of conflict to maintain an optimal level of organizational performance. For example, Shelton and Darling suggest conflict is a necessary condition for both individual and organizational progression. They encourage managers to "embrace conflict and use it for continuous transformation."

### SOURCES OF CONFLICT

According to both Daft and Terry, several factors may create organizational conflict. They are as follows:

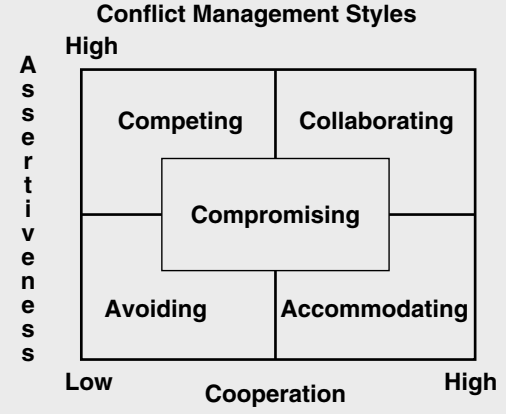
- Scarce Resources. Resources may include money, supplies, people, or information. Often, organizational units are in competition for scarce or declining resources. This creates a situation where conflict is inevitable.

- Jurisdictional Ambiguities. Conflicts may also surface when job boundaries and task responsibilities are unclear. Individuals may disagree about who has the responsibility for tasks and resources.
- Personality Clashes. A personality conflict emerges when two people simply do not get along or do not view things similarly. Personality tensions are caused by differences in personality, attitudes, values, and beliefs.
- Power and Status Differences. Power and status conflict may occur when one individual has questionable influence over another. People might engage in conflict to increase their power or status in an organization.
- Goal Differences. Conflict may occur because people are pursuing different goals. Goal conflicts in individual work units are a natural part of any organization.
- Communication Breakdown. Communication-based barriers may be derived from differences in speaking styles, writing styles, and nonverbal communication styles. These stylistic differences frequently distort the communication process. Faulty communication leads to misperceptions and misunderstandings that can lead to long-standing conflict. Additional barriers to communication may emerge from the cross-gender and cross-cultural differences of participants. Such fundamental differences may affect both the ways in which the parties express themselves and how they are likely to interpret the communication they receive. These distortions, in turn, frequently result in misreading by the parties involved. Moreover, it is common for the parties involved to be oblivious to these false impressions. The resultant misunderstandings subsequently lead the parties involved to believe that a conflict based on misunderstood behavior exists when, in fact, no conflict actually does exist. Miller and Steinberg call this misreading "pseudo-conflict," that is, perceived conflict rather than actual conflict. Much of what managers take to be an actual conflict is the product of such pseudo-conflict.

## CONFLICT MANAGEMENT METHODOLOGIES

Management theorists have developed and suggested a range of options for handling organizational conflict. Figure 1 outlines the various components of the Conflict Resolution Grid, which is the result of widely accepted research presented by Thomas and Kilmann.

**Figure 1**
**Based on Thomas-Kilmann Conflict Mode Instrument**




Thomas and Kilmann identified a conflict-handling grid comprised of five conflict management styles based on two dimensions: assertiveness and cooperativeness. Assertiveness is the motivation of an individual to achieve his/her own goals, objectives, and outcomes, while cooperativeness assesses the willingness to allow or help the other party to achieve its goals or outcomes. Any of the five conflict resolution styles might be appropriate based on the circumstances of the situation and the personalities of the individuals involved.

1. Avoiding Conflict Resolution Style. The avoiding style is low on both assertiveness and cooperativeness. In other words, the manager is not very cooperative in helping the other individuals to achieve their goals, but neither is he/she aggressively pursuing his/her own preferred outcomes in the situation. The original problem, conflict, or situation is never directly addressed or resolved. However, avoiding behavior might be appropriate when the issue is perceived by the manager to be trivial. It might also be an appropriate approach to use when there is no chance of winning or when disruption would be very costly.
2. Competing Conflict Resolution Style. The competing style of resolving conflict is also known as the win-lose approach. A manager using this style, characterized by high assertiveness and low cooperativeness, seeks to reach his/her own preferred outcomes at the expense of other individuals. This approach may be appropriate when quick,

decisive action is needed, such as during emergencies. It can also be used to confront unpopular actions, such as urgent cost cutting.

3. Accommodating Conflict Resolution Style. This style reflects a high degree of cooperativeness. It has also been labeled as obliging. A manager using this style subjugates his/her own goals, objectives, and desired outcomes to allow other individuals to achieve their goals and outcomes. This behavior is appropriate when people realize that they are in the wrong or when an issue is more important to one side than the other. This conflict resolution style is important for preserving future relations between the parties.
4. Compromising Conflict Resolution Style. This style is characterized by moderate levels of both assertiveness and cooperativeness. Compromise can also be referred to as bargaining or trading. It generally produces suboptimal results. This behavior can be used when the goals of both sides are of equal importance, when both sides have equal power, or when it is necessary to find a temporary, timely solution. It should not be used when there is a complex problem requiring a problem-solving approach.
5. Collaborating Conflict Resolution Style. This approach, high on both assertiveness and cooperativeness, is often described as the win-win scenario. Both sides creatively work towards achieving the goals and desired outcomes of all parties involved. The collaboration style is appropriate when the concerns are complex and a creative or novel synthesis of ideas is required. The downside of this approach is that the process of collaborating mandates sincere effort by all parties involved and it may require a lot of time to reach a consensus.

Of the five modes described in the matrix, only the strategy employing collaboration as a mode of conflict management breaks free of the win-lose paradigm. It has become almost habitual to fall back on the win-win alternative, but this was not the authors' original intention. They did not reject win-lose configurations out of hand. Instead, strategic considerations for managing conflict according to varied circumstances were identified. For instance, in a conflict centered on bids by two alternative suppliers, the best choice might well be a competing strategy with a winner and loser. After all, the objective in such a situation is to win the contract for one's own company. In most cases, winning the contract can be accomplished only at the expense of the competing supplier, who by definition becomes the loser.

In contrast, a competing approach almost never works well in the interpersonal conflict of people working in the same office (or even the same organization). Unlike the case of competing suppliers, coworkers—both the winner and the loser—must go on working together. Indeed, in many conflicts revolving around office politics, an accommodating strategy may actually enable individuals to strengthen their future negotiating position through allowing themselves to lose in conflicts over issues they do not feel particularly strongly about. In such situations, accommodating can be seen as a form of winning through losing. For instance, a manager may choose to concede an issue to an employee who is experiencing considerable stress as a means to motivate him or her. Similarly, an individual might choose an accommodating strategy to add balance to negotiations in which one's counterpart has already had to give up several other points. Indeed, a winner in a win-lose scenario who fails to put forth some effort to accommodate the other party may even provoke a backlash in the form of lack of commitment or open resistance.

Even the traditional approach of conflict avoidance has its place as an occasionally acceptable strategy. While conflict avoidance has justly been the subject of considerable condemnation, it can be rather useful in allowing both parties to cool off or in buying time until all the facts of a matter have been gathered. A manager might choose to avoid an employee in the throes of an emotional outburst, for example, until the employee has had sufficient time to calm down.

Finally, compromise is often a useful strategy when dealing with relatively small concerns. This differs from an accommodating strategy, in which the conceding party finds an issue unimportant that the opposing party considers comparatively important. A manager might enlist a compromise approach most effectively when both parties consider the issue to be of moderate or little importance. In such cases, compromising saves both parties the time required to employ problem-solving techniques to address the fundamental core of the conflict.

While all of these modes have their place among the strategies available to the manager, the collaborating approach to conflict management represents the most beneficial mode for most types of conflict management. In the collaborating mode, conflict itself acts as a managerial tool. The manager utilizes the conflict to guide the conflicting parties to address what essentially are obstacles faced by the organization. Through collaborative behavior, the conflicting parties pool their creative energies to find innovative answers to old problems.

It is in this key respect that the collaborative mode of conflict management differs from the other four conflict-handling modes. Accommodating, avoiding, competing, and compromising—as permutations of

the win-lose scenario—are simply forms of conflict interventions. Collaboration as a conflict-handling mode, on the other hand, represents an attempt to channel conflict in a positive direction, thus enabling the manager to use conflict as a tool to resolve otherwise incompatible objectives within the organization. In other words, this method of handling conflict acts less as a conflict intervention and more as true conflict management.

However, any of the five conflict resolution styles may be appropriate and effective depending on the specific situation, the parties' personality styles, the desired outcomes, and the time available, The key to becoming more prepared is to understand the advantages and disadvantages of each method.

## THE FIVE A'S TECHNIQUE

Borisoff and Victor identify five steps in the conflict management process that they call the "five A's" of conflict management: assessment, acknowledgement, attitude, action, and analysis. They assert that these five steps allow for a sustained, ongoing process of problem-solving-oriented conflict management.

**ASSESSMENT.** In the assessment step, the parties involved collect appropriate information regarding the problem. The parties involved also choose which of the conflict-handling modes is most appropriate for the situation. The parties collectively decide what is and what is not central to the problem. The parties involved also indicate areas in which they may be willing to compromise, and what each party actually wants.

**ACKNOWLEDGEMENT.** The acknowledgement step is one in which each party attempts to hear out the other. Acknowledgement allows both parties to build the empathy needed for the motivation of a synergistic solution to the problem. The acknowledgement acts as feedback to the other party and it demonstrates that one understands (without necessarily agreeing with) the other party's position. Acknowledgement goes beyond merely responding to what is said, however; it involves actively encouraging the other party to openly communicate its concerns. This is aided by the use of active listening techniques and overt, nonverbal encouragement.

**ATTITUDE.** The attitude step tries to remove the foundation for pseudo-conflict. Stereotypical assumptions about different, culturally-based behaviors are uncovered. For example, a member of a high-context culture may misinterpret what a member of a low-context culture says as being needlessly blunt or even rude. Conversely, a member of a low-context culture may misinterpret what a person from a high-context culture says as being needlessly indirect or even outright deceptive. Such communication variations (as the works of Edward Hall have explained) have little to do with the actual intent or content of the messages, but represent instead culturally learned approaches to using implicit versus explicit communication styles. Similarly, in the attitude step, one acknowledges differences in the way that men and women are generally conditioned to communicate. Experts such as Borisoff and Merrill, for example, have delineated clearly differentiated communication styles between men and women, which are compounded by sex-trait stereotyping regarding issues of assertiveness, interruptive behavior, and perceptions of politeness. Finally, in the attitude step, one analyzes potentially problematic variations in styles of writing, speaking, and nonverbal mannerisms. Such differences may blur meanings. It is the role of the effective conflict participant to maintain an open mind toward all parties involved.

**ACTION.** The action step begins to actively implement the chosen conflict-handling mode. If the selected mode is the problem-solving approach, the manager conveys the opportunity for a conflict resolution based on trust and ongoing feedback on those points on which the parties have already agreed. Simultaneously, each individual evaluates the behavior of the other parties (often, little more than subtle hints) to ascertain where potential trouble spots might arise. Also, each individual must remain aware of his or her own communication style and general behavior. Finally, all parties must stay alert to new issues that are raised and look for productive solutions.

**ANALYSIS.** In this last step participants decide on what they will do, and then summarize and review what they have agreed upon. Part of the analysis step is to ascertain whether every participant's requirements have been addressed (and met, if possible). Finally, the analysis step initiates the impetus for approaching conflict management as an ongoing process. Analysis enables participants to monitor both the short-term and long-term results of the conflict resolution.

## QUANTUM SKILLS

Shelton and Darling suggest a new set of management skills, more appropriate for the ever-changing, conflict-ridden contemporary organization. They refer to these skills as the quantum skills. The suggested managerial skills are derived from the field of quantum physics. They are as follows:

1. Quantum seeing. This skill is defined as the ability to see intentionally. When conflict occurs, managers must explore their own assumptions about the parties and search for the underlying intentions that are creating the conflict. Each party must then come to

recognize the relationship between individual thought processes and perceptions, and set clear intentions for positively resolving the situation.

2. Quantum thinking. This skill involves the ability to think paradoxically. Effective conflict resolution is a paradoxical process. "Win-win solutions require paradoxical thinking. They require the ability to find a fully acceptable solution to divergent points of view" (Shelton and Darling 2004, p. 30). In other words, collaborative solutions to conflicts that involve diametrically-opposed positions are unlikely to be achieved through linear problem-solving processes and thus require more unorthodox thinking.
3. Quantum feeling. This skill is defined as the ability to feel vitally alive. It is based on the premise that the level of organizational conflict is influenced by the negative emotions pervasive throughout the business world. As schedules have become more fast-paced and jobs have become more stressful, the level of organizational conflict has increased. Managers committed to the quantum feeling technique of conflict management must train themselves to view even negative events positively. They must challenge all parties in conflict to utilize creative, brain-storming techniques in an effort to construct "impossible" win-win solutions.
4. Quantum knowing. This skill is the ability to know intuitively. Managers wishing to develop this skill must integrate times of relaxation and reflection into their work routines. This skill focuses on staying mindful or aware of the organizational environment. Managers involved in conflict situations must guide all parties towards a more centered response to the negative emotions.
5. Quantum acting. This skill is based on the ability to act responsibly. Quantum acting is predicated on the belief that everything in the universe is a part of a complex whole in which each part is influenced by every other part. Therefore, a manager's thoughts affect the entire organizational unit. Thus, if managers want to encourage more creative responses to conflict, they must begin by modeling this behavior themselves.
6. Quantum trusting. This skill is the ability to trust life's process. It is derived from chaos theory. This theory suggests that without chaos organizations will become stagnant and, if left alone, they will return to a nonchaotic state. This skill may be appealing to managers experiencing conflict. It suggests that managers must simply "ride the rapids of conflict, fully participating in the dance without attempting to actively manage the course of resolution" (Shelton and Darling 2004, p. 37). The organizational unit will eventually self-organize.
7. Quantum being. This skill is the ability to be in a relationship, specifically, "the ability to literally become so connected to another that one can see the world through the other's eyes" (Shelton and Darling 2004, p.38). This skill provides the foundation for all parties to learn from and understand each other. It is a relationship of continuous learning.

This set of skills is grounded in a new science: worldview. These skills provide a whole-brained alternative for managing people and conflict.

Conflict management is an ongoing procedure. It entails continual communication and supervision. "Conflict-handling behavior is not a static procedure; rather it is a process that requires flexibility and constant evaluation to truly be productive and effective" (Borisoff and Victor 1998).

*SEE ALSO:* Diversity; Management Styles

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*Revised by Patricia A. Lanier*

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## CONSULTING

Management consulting is generally a contract advisory service provided to organizations in order to identify management problems, analyze them, recommend solutions to these problems, and when requested, help implement the solutions. Although there are few formal educational or professional requirements to be a consultant, these services are ideally provided by individuals who are specially trained or qualified in a particular field, such as information technology or organizational change, and who strive to provide independent, objective advice to the client organization.

Only a moderate amount of research has been done on the management consulting industry, although the industry has experienced a phenomenal growth rate since essentially emerging during the 1980s. Management consultants perform a variety of services and use many different methods to complete their tasks. These external consultants do not take the place of managers and have no formal authority, although they are responsible for the value of their advice—occasionally in a legal sense.

The practice itself has existed since the early 1900s. Management consulting pioneers such as Arthur D. Little and Harrington Emerson contributed much to the foundations of the concept. The two were also involved with the founding of the first consulting firms. In the first half of the twentieth century, consultants began to expand on the earlier work. They began offering what was termed "business research" and introduced such business practices as budgeting, divisionalized organization, merit-based compensation schemes, and forecasting methods. During the early postwar years, and in many cases growing out of wartime experience, consulting experienced a big rush, with the formation of such firms as Cresap, McCormick & Paget, William E. Hill, Hay Associates, and Towers Perrin. In the 1960s, major accounting firms began to take notice of the growing market for consulting and began to offer consulting services of their own (however, by the late 1990s charges of conflicts of interest would cause some of these firms to distance their accounting practices from their consulting activities). Also at this time, with the formation of the Cambridge Research Institute and Management Analysis Center, consulting firms began to integrate methodology of the bigger firms and consolidate practices.

In the early 1980s there were an estimated 18,000 management consultants. Only 30 to 40 percent of these were employed in the large, institutionally organized firms. Since then the industry has experienced robust growth, with a particular surge during the 1990s dot.com period. *Money* magazine's February 1992 issue cited a 52 percent increase in the management consulting industry from 1978 to 1992. Today, management consulting is a $70 billion industry. There were an estimated 140,000 management consultants worldwide in 2000, with 70,000 residing in the United States alone. This can be compared to the estimated 150,000 American executives that management consultants interact with in the business world. For every executive, there are 0.5 management consultants, as opposed to 1980, when there were 0.1 for every executive. This exemplifies the dramatic growth the industry has undertaken in recent years.

There are four basic areas within the Consulting industry. Management Consulting consists of looking at a company's organization to assess its ability to achieve its goals. Strategic Consulting focuses on the direction and goals of a company as they relate to their specific industry. Information Technology (IT) Consulting brings technology advice to a company to improve its effectiveness and efficiency. Industry Specific Consulting brings expertise to highly specialized businesses.

E.H. Schein has divided the role of the management consultant into three categories. These roles are classified as purchase of expertise, doctor-patient, and process consultation. The purchase of expertise role is considered a "hands-off" approach in which the consultant brings his/her own views or opinions into the situation. The doctor-patient role is a more personal relationship between the client and consultant in which the consultant analyzes and assesses the threats to the company. In the process-consultation method, the consultant plays more of a facilitator role. The client provides the information necessary while the consultant defines the problems and creates the possible solutions. The client makes the final decision on how to resolve the problem.

D.B. Nees and L.E. Greiner have also divided the interaction between consultants and clients into five similar categories. The "mental adventurer" assesses long-term scenarios by using economic models and personal experience. The "strategic navigator" makes decisions based on quantitative data of the industry and makes choices without input from the client. The "management physician" makes decisions based on knowledge of the organization as opposed to the industry as a whole. The "system architect" directs the client by redefining and improving the routines and processes of the organization. Lastly, the "friendly copilot" acts as a counselor to senior management and does not offer any new ideas or knowledge to the client. The mental adventurer role correlates to Schein's expert model; the strategic navigator, management physician, and system architect to Schein's doctor-patient model; and the friendly co-pilot to Schein's process-consultation model.

Over the years, the relationship between the client and consultant has evolved into an intimate partnership. A.N. Turner has developed several task categories to describe management consulting approaches. These categories include supplying information to the client; figuring out clients' problems; making a diagnosis of the problem; producing proposals based on the diagnosis; aiding with the implementation of recommended actions; providing client learning; and perpetually improving organizational effectiveness. The first categories represent traditional roles of consultants, while the last represent newer, evolving tasks. Although the relationship is becoming more sophisticated and complex, it still has a long way to go. An executive is still more likely to be influenced by his or her own instincts, followed by the advice of the planning staff, board of directors, and investment bankers, before he or she is persuaded by management consultants.

The existence and phenomenal growth rate of the management consulting industry cannot be easily explained. However, Marvin Bower, of McKinsey & Company, a large consulting firm, offers six reasons why companies should hire consultants. First, consultants offer extensive knowledge and access to resources not available internally. Consultants also contribute broad experience in the field. Next, consultants possess the time to research and analyze the problem. Consultants are also professionals. They are also independent of their clients and are able to make objective decisions the client might not be able to make. Lastly, consultants have the ability to implement the recommendations they provide to their clients. In large organizations, many of the problems encountered should be able to be handled internally because they have dealt with them in the past. In this case, time would be the deciding factor on whether the problems were handled internally or outsourced to management consultants.

Depending on the respective firms, consultants most often have certain requirements for targeting potential clients. The level of engagement or difficulty is one factor to be considered. Some firms such as Gemini Consulting, another major player, are looking for "multidimensional engagements that address bottom-line business issues." These companies would rather deal with "high-end engagements" as opposed to routine supply chain work. The length of time involved is another factor to be considered. Some firms like to work with long-term engagements, where strategy can be developed and implemented over time. Other firms are content with taking on short-term discrete jobs. Larger firms tend to focus their attention on larger companies, and companies like McKinsey & Company tend to focus on engagements that "excite" their consultants. They enjoy making transformations and radical changes not only to the companies themselves, but to the industry as a whole.

Management consultants are becoming increasingly discriminating about the clients they accept in order to protect their reputations and ensure the success of the engagements. Some consultants base their evaluations on whether the proposed project will have a profound impact on the company. Some will only accept a client if they believe the project will be successful, while others look for clients that share their core values. It is not uncommon for prospective clients to ask for a proposal over the telephone. A work session is usually conducted to gather information and address problems. If the prospect states it does not have the time for a work session, the case is usually not taken. Consultants clearly avoid prospective clients who have already decided what they want to do before soliciting the consultant. It is estimated that up to 70 percent of clients begin the consulting process by asking the wrong questions. It is the consultant's responsibility to get the client's priorities in line and have the management focus on problems facing the company. This may explain the current rise in "relationship consulting" whereby a consultant works with a company for several years to see strategies implemented and changed as new challenges are faced by the company.

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## CONSUMER BEHAVIOR

A consumer is the ultimate user of a product or service. The overall consumer market consists of all buyers of goods and services for personal or family use, more than 270 million people (including children) spending trillions of dollars in the United States as of the late 1990s.

Consumer behavior essentially refers to how and why people make the purchase decisions they do. Marketers strive to understand this behavior so they can better formulate appropriate marketing stimuli

that will result in increased sales and brand loyalty. There are a vast number of goods available for purchase, but consumers tend to attribute this volume to the industrial world's massive production capacity. Rather, the giant known as the marketing profession is responsible for the variety of goods on the market. The science of evaluating and influencing consumer behavior is foremost in determining which marketing efforts will be used and when.

To understand consumer behavior, experts examine purchase decision processes, especially any particular triggers that compel consumers to buy a certain product. For example, one study revealed that the average shopper took less than 21 minutes to purchase groceries and covered only 23 percent of the store, giving marketers a very limited amount of time to influence consumers. And 59 percent of all supermarket purchases were unplanned. Marketers spend a great deal of time and money discovering what compels consumers to make such on-the-spot purchases. Market researchers obtain some of the best information through in-store research, and will often launch new products only in select small venues where they expect a reasonable test of the product's success can be executed. In this manner, they can determine whether a product's success is likely before investing excessive company resources to introduce that product nationally or even internationally.

## CONSUMER NEEDS

Consumers adjust purchasing behavior based on their individual needs and interpersonal factors. In order to understand these influences, researchers try to ascertain what happens inside consumers' minds and to identify physical and social exterior influences on purchase decisions.

On some levels, consumer choice can appear to be quite random. However, each decision that is made has some meaning behind it, even if that choice does not always appear to be rational. Purchase decisions depend on personal emotions, social situations, goals, and values.

People buy to satisfy all types of needs, not just for utilitarian purposes. These needs, as identified by Abraham Maslow in the early 1940s, may be physical or biological, for safety and security, for love and affiliation, to obtain prestige and esteem, or for self-fulfillment. For example, connecting products with love or belonging has been a success for several wildly popular campaigns such as "Reach Out and Touch Someone," "Fly the Friendly Skies," and "Gentlemen Prefer Hanes." This type of focus might link products either to the attainment of love and belonging, or by linking those products with people similar to those with whom people would like to associate.

Prestige is another intangible need, and those concerned with status will pay for it. However, goods appealing to this type of need must be viewed as high-profile products that others will see in use. One benefit of targeting this type of market is that the demand curve for luxury products is typically the reverse of the standard; high-status products sell better with higher prices.

Some equate the type of need to be met with certain classes of goods. For instance, a need for achievement might drive people to perform difficult tasks, to exercise skills and talents, and to invest in products such as tools, do-it-yourself materials, and self-improvement programs, among others. The need to nurture or for nurturing leads consumers to buy products associated with things such as parenthood, cooking, pets, houseplants, and charitable service appeals.

Personality traits and characteristics are also important to establish how consumers meet their needs. Pragmatists will buy what is practical or useful, and they make purchases based more on quality and durability than on physical beauty. The aesthetically inclined consumer, on the other hand, is drawn to objects that project symmetry, harmony, and beauty. Intellectuals are more interested in obtaining knowledge and truth and tend to be more critical. They also like to compare and contrast similar products before making the decision to buy. Politically motivated people seek out products and services that will give them an "edge," enhancing power and social position. And people who are more social can best be motivated by appealing to their fondness for humanity with advertising that suggests empathy, kindness, and nurturing behavior. One successful way an insurance company targeted this market was through its "You're in good hands with Allstate" campaign.

Consumers also vary in how they determine whose needs they want to satisfy when purchasing products and services. Are they more concerned with meeting their own needs and buying what they want to, for their own happiness? Or do they rely on the opinions of others to determine what products and services they should be using? This determines, for example, whether or not they will make a purchase just because it's the newest, most popular item available or because it is truly what they need and/or want.

This also influences the way marketers will advertise products. For example, a wine distributor trying to appeal to people looking to satisfy their personal taste will emphasize its superior vintage and fine bouquet; that same distributor, marketing to those who want to please others, will emphasize how sharing the wine can improve gatherings with friends and family.

Cultural and social values also play large roles in determining what products will be successful in a given market. If great value is placed on characteristics

such as activity, hard work, and materialism, then companies who suggest their products represent those values are more likely to be successful. Social values are equally important. If a manufacturer suggests their product will make the consumer appear more romantic or competitive in a place where those values are highly regarded, it is more likely consumers will respond.

## PURCHASE PATTERNS

While all of this information might be helpful to marketers, it is equally important to understand what compels the consumer to actually make a purchase, as opposed to just generating interest. For example, some consumers respond based on how they are feeling, or more emotionally, while some are focused on making the wisest economic decision. Knowing the different elements that stimulate consumer purchase activity can help marketers design appropriate sales techniques and responses.

A study conducted by Susan Powell Mantel focused on analyzing the roles of "attribute-based processing" and "attitude-based processing" when analyzing consumer preference. According to the study, product attributes (qualities such as price, size, nutritional value, durability, etc.) are often compared disproportionately, i.e., one is the more focal subject of comparison, thus eliciting more consideration when the consumer decides which brand is the "best." The order of brand presentation in these cases is particularly important.

Adding to the complexity of the issue is the fact that purchase decisions are not always made on the basis of an "attribute-by-attribute" comparison (attribute-based processing). Consumers also make decisions based on an overall evaluation of their impressions, intuition, and knowledge based on past experience, or attitude-based processing. Learned attitudes also influence these decisions. For example, parents who drank Kool-Aid as children often buy it for their kids, either because they associate it with fond memories or just because of brand familiarity or loyalty.

There is time and effort associated with each of these strategies, though attribute-based processing requires significantly more effort on the consumer's part. To dedicate the time required for an attribute-by-attribute comparison, consumers need the combination of motivation and the time or opportunity to use such a strategy.

Other contributing factors were discussed in Mantel's study, such as personality differences and each individual's "need for cognition." Need for cognition reflects to what extent individuals "engage in and enjoy thinking." People with a high need for cognition tend to evaluate more and make more optimal in-store purchase decisions. This is in part because they do not react to displays and in-store promotions unless significant price reductions are offered. Low-need cognition people react easily when a product is put on promotion regardless of the discount offered.

Consumers are also affected by their perceived roles, which are acquired through social processes. These roles create individuals' needs for things that will enable them to perform those roles, improve their performance in those roles, facilitate reaching their goals, or symbolize a role/relationship, much in the way a woman's engagement ring symbolizes her taking on the role of a wife.

Other factors that influence purchase decisions include the importance attributed to the decision. People are not likely to take as much time doing brand comparisons of mouthwash as they are a new car. The importance of the purchase, as well as the risk involved, adds to how much time and effort will be spent evaluating the merits of each product or service under consideration. In cases of importance such as the purchase of a car or home appliance, consumers are more likely to use rational, attribute-based comparisons, in order to make the most informed decision possible.

In some cases, consumers make very little effort to evaluate product choices. "Habitual evaluation" refers to a state in which the consumer disregards marketing materials placed in a store, whether because of brand loyalty, lack of time, or some other reason. Indeed, evaluating all relevant marketing information can become time consuming if it is done every time a person shops.

On the opposite side of the coin, "extensive evaluation" is the state in which consumers consider the prices and promotions of all brands before making a choice. There are also in-between states of evaluation, depending again on the importance of the purchase and the time available to make a decision (some consumers, usually those who earn higher incomes, value their time more than the cost savings they would incur). Decisions on whether to compare various products at any given time may be a factor of the anticipated economic returns, search costs or time constraints, and individual household purchasing patterns.

When it comes time to actually make purchases, however, one person in the family often acts as an "information filter" for the family, depending on what type of purchase is being made and that person's expertise and interest. The information filter passes along information he or she considers most relevant when making a purchase decision, filtering out what is considered unimportant and regulating the flow of information. For example, men are more often the family members who evaluate which tools to purchase, while children pass along what they consider to be seminal information about toys. At times, family

members may take on additional roles such as an "influencer," contributing to the overall evaluation of goods being considered for purchase. Or one person may act as the "decider," or the final decision-maker. Ultimately, purchase decisions are not made until consumers feel they know enough about the product, they feel good about what they're buying, and they want it enough to act on the decision.

## INTERPRETING CONSUMER BEHAVIOR

When market researchers begin evaluating the behavior of consumers, it is a mistake to rely on conventional wisdom, especially when it is possible to study the actual activity in which consumers are engaged when using a product or service. Where are they when they buy certain items? When do they use it? Who is with them when they make the purchase? Why do they buy under certain circumstances and not others? Researchers need to determine the major needs being satisfied by that good or service in order to effectively sell it.

There are two principal ways to evaluate the motivation behind consumer purchases. These are by direction (what they want) and intensity (how much they want it). Direction refers to what the customer wants from a product. For example, if a customer is selecting pain reliever, they may like the idea is one pain reliever is cheaper than another, but what they really want is fast pain relief, and will probably pay more if they think the more expensive brand can do that more effectively. Marketers need to understand the principal motivation behind each type of product to correctly target potential customers.

The other way to evaluate consumer behavior, intensity, refers to whether a customer's interest in a product is compelling enough that they will go out and make the purchase. Good marketing can create that kind of intensity. A successful example of such a campaign was Burger King's "Aren't You Hungry?" campaign, which aired on late-night television and was compelling enough for people to leave their homes late at night to go out and buy hamburgers. Understanding consumer motivation is the best way to learn how to increase buyer incentive, as well as a better alternative to the easy incentive-decreasing the price.

While it is easy to speculate on all these elements of consumer motivation, it is much harder to actively research motivating factors for any given product. It is rare that a consumer's reasons for buying a product or service can be accurately determined through direct questioning. Researchers have had to develop other ways to get real responses. These include asking consumers "How do you think a friend of yours would react to this marketing material?" While consumers do not like to admit that marketing affects them at all, they are often willing to speculate on how it would affect someone else. And most often they answer with what would be their own responses.

Another tactic that has proven successful is to ask consumers "What kind of person would use this type of product?" By asking this question, market researchers can determine what the consumer believes buying the product would say about them, as well as whether or not they would want to be seen as that type of person.

## INFLUENCING CONSUMER BEHAVIOR

One of the best ways to influence consumer behavior is to give buyers an acceptable motive. This is somewhat related to the idea of asking what type of person would buy a certain product in evaluating consumer behavior. Consumers want to feel they're doing something good, being a good person, eating healthy, making contacts, keeping up appearances, or that they just deserve to be spoiled a little bit. If marketers can convince consumers that they need a product or service for some "legitimate" reason, customers will be more likely to make a purchase.

In addition, sensory stimuli are important to marketing. When food packages are appealing or associated with other positive qualities, people often find that they "taste" better. For example, people often "taste" with their eyes, discerning differences in products where they do not see any difference during a blind taste test. One of the best examples of this was a test of loyal Coca-Cola customers who were totally unwilling to concede that any other soda was its equal. While able to see what they were drinking, they maintained this position. But during blind testing, some were unable to tell the difference between Coke and root beer.

Finally, another alternative for influencing customer behavior is by offering specialized goods. While commonality was once popular, more and more people are seeking diversity in taste, personal preferences, and lifestyle. Some successful campaigns touting the way their products stand out from the crowd include Dodge's "The Rules Have Changed" and Arby's "This is different. Different is good."

In fact, marketers are quite successful at targeting "rebels" and the "counterculture," as it is referred to in *Commodify Your Dissent.* As Thomas Frank writes, "Consumerism is no longer about 'conformity' but about difference. It counsels not rigid adherence to the taste of the herd but vigilant and constantly updated individualism. We consume not to fit in, but to prove, on the surface at least, that we are rock 'n' roll rebels, each one of use as rule-breaking and hierarchy-defying as our heroes of the 60s, who now pitch cars, shoes, and beer. This imperative of endless difference is today the genius at the heart of American capitalism, an eternal fleeing from 'sameness' that satiates

our thirst for the New with such achievements of civilization as the infinite brands of identical cola, the myriad colors and irrepressible variety of the cigarette rack at 7-Eleven."

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## CONTINGENCY APPROACH TO MANAGEMENT

The contingency approach to management is based on the idea that there is no one best way to manage and that to be effective, planning, organizing, leading, and controlling must be tailored to the particular circumstances faced by an organization. Managers have always asked questions such as "What is the right thing to do? Should we have a mechanistic or an organic structure? A functional or divisional structure? Wide or narrow spans of management? Tall or flat organizational structures? Simple or complex control and coordination mechanisms? Should we be centralized or decentralized? Should we use task or people oriented leadership styles? What motivational approaches and incentive programs should we use?" The contingency approach to management (also called the situational approach) assumes that there is no universal answer to such questions because organizations, people, and situations vary and change over time. Thus, the right thing to do depends on a complex variety of critical environmental and internal contingencies.

### HISTORICAL OVERVIEW

Classical management theorists such as Henri Fayol and Frederick Taylor identified and emphasized management principles that they believed would make companies more successful. However, the classicists came under fire in the 1950s and 1960s from management thinkers who believed that their approach was inflexible and did not consider environmental contingencies. Although the criticisms were largely invalid (both Fayol and Taylor, for example, recognized that situational factors were relevant), they spawned what has come to be called the contingency school of management. Research conducted in the 1960s and 1970s focused on situational factors that affected the appropriate structure of organizations and the appropriate leadership styles for different situations. Although the contingency perspective purports to apply to all aspects of management, and not just organizing and leading, there has been little development of contingency approaches outside organization theory and leadership theory. The following sections provide brief overviews of the contingency perspective as relevant to organization theory and leadership.

### CONTINGENCY PERSPECTIVE AND ORGANIZATION THEORY

Environmental change and uncertainty, work technology, and the size of a company are all identified as environmental factors impacting the effectiveness of different organizational forms. According to the contingency perspective, stable environments suggest mechanistic structures that emphasize centralization, formalization, standardization, and specialization to achieve efficiency and consistency. Certainty and predictability permit the use of policies, rules, and procedures to guide decision making for routine tasks and problems. Unstable environments suggest organic structures which emphasize decentralization to achieve flexibility and adaptability. Uncertainty and unpredictability require general problem solving methods for nonroutine tasks and problems. Paul Lawrence and Jay Lorsch suggest that organizational units operating in differing environments develop different internal unit characteristics, and that the greater the internal differences, the greater the need for coordination between units.

Joan Woodward found that financially successful manufacturing organizations with different types of work technologies (such as unit or small batch; large-batch or mass-production; or continuous-process) differed in the number of management levels, span of management, and the degree of worker specialization. She linked differences in organization to firm performance and suggested that certain organizational forms were appropriate for certain types of work technologies.

Organizational size is another contingency variable thought to impact the effectiveness of different organizational forms. Small organizations can behave informally while larger organizations tend to become more formalized. The owner of a small organization may directly control most things, but large organizations require more complex and indirect control mechanisms. Large organizations can have more specialized staff, units, and jobs. Hence, a divisional structure is not appropriate for a small organization but may be for a large organization.

In addition to the contingencies identified above, customer diversity and the globalization of business may require product or service diversity, employee diversity, and even the creation of special units or divisions. Organizations operating within the United States may have to adapt to variations in local, state, and federal laws and regulations. Organizations operating internationally may have to adapt their organizational structures, managerial practices, and products or services to differing cultural values, expectations, and preferences. The availability of support institutions and the availability and cost of financial resources may influence an organization's decision to produce or purchase new products. Economic conditions can affect an organization's hiring and layoff practices as well as wage, salary, and incentive structures. Technological change can significantly affect an organization. The use of robotics affects the level and types of skills needed in employees. Modern information technology both permits and requires changes in communication and interaction patterns within and between organizations.

## CONTINGENCY PERSPECTIVE AND LEADERSHIP

Dissatisfaction with trait-based theories of leadership effectiveness led to the development of contingency leadership theories. Fred Fiedler, in the 1960s and 1970s, was an early pioneer in this area. Various aspects of the situation have been identified as impacting the effectiveness of different leadership styles. For example, Fiedler suggests that the degree to which subordinates like or trust the leader, the degree to which the task is structured, and the formal authority possessed by the leader are key determinants of the leadership situation. Task-oriented or relationship oriented leadership should would each work if they fit the characteristics of the situation.

Other contingency leadership theories were developed as well. However, empirical research has been mixed as to the validity of these theories.

*SEE ALSO:* Decision Making; Leadership Styles and Bases of Power; Management Styles; Organizational Structure

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# CONTINGENT WORKERS

As a category, contingent workers may include temporary employees, part-time employees, independent contract workers, employees of the temporary help industry ("temps"), consultants, seasonal employees, and interns. In contrast, full-time, permanent employees frequently are referred to as core employees. The U.S. Bureau of Labor Statistics (BLS) defines contingent workers in a more selective way. The BLS differentiates between workers with what it calls "alternative work arrangements" and contingent workers, who have no explicit or implicit contract and expect their jobs to last no more than a year.

## TYPES OF CONTINGENT WORKERS

There is much discussion in the literature about just how the term *contingent worker* should be defined. Following are descriptions of common contingent worker categories.

**TEMPS.** Temporary employees, or temps, generally work for temporary employment agencies that place workers in companies for short-term assignments. While most temporary employees earn less than their full-time counterparts and do not receive benefits, that has changed for some job specialties, particularly in the computer and information systems areas. Milwaukee-based Manpower Inc. and Kelly Services Inc. of Troy, Michigan, are two of the largest temporary agencies.

**PART-TIME EMPLOYEES.** Part-time employees work fewer than 35 hours a week. They often receive fewer or no benefits from their employer, which results in a cost savings for the company. Additionally, these employees may be scheduled to meet particular peak needs of the organization. For example, clothing stores have higher night and weekend demand for staff than during the week daytime hours.

**CONTRACT WORKERS.** Contract workers are employees who negotiate a relationship directly with an employer for a particular piece of work or for a specific time period. Contract workers generally are self-employed and determine their own work hours. These employees may be more productive than in-house employees because they avoid much of the bureaucracy of day-to-day organizational life.

**COLLEGE INTERNS.** College interns are students who work for a company for either no salary or a reduced salary to gain work experience. These interns may work full-time or part-time, but they are likely to work for only a short time period, usually a semester or a summer. Interns are contingent workers because they provide a company with staffing flexibility. In addition, the company may choose to offer the intern full-time employment at the end of the internship.

## TRENDS

After the fallout from downsizing during the 1980s, organizations have increasingly looked to various strategies for building more flexible workforces. Additionally, because of increasing and rapid changes in the world economy, including both competitive and regulatory forces, the ability to make low-cost staffing adjustments has become imperative. Factoring in the desire of many employees to have more flexible work arrangements, this has caused the contingent workforce to experience considerable growth during the 1990s and 2000s.

These variations in part-time, temporary, and/or contractual work arrangements certainly form a growing segment of the U.S. labor force. In 2001 the BLS estimated that contingent workers made up 24 percent of the American workforce. Approximately 22 million people worked part-time, 9 million were contract workers, and 1.2 million were temporary employees. This is a significant increase from BLS data in 1995, which estimated that between 2.7 and 6 million employees held contingent jobs. To some degree, contingent employment levels change due to unemployment levels. In a tight labor market, many employees find full-time core employment, but in times of higher unemployment there may be increases in contingent work.

## ADVANTAGES AND DISADVANTAGES

Two of the major advantages of using contingent workers are staffing flexibility for the firm and reduced costs. Staffing becomes more flexible for a firm if it uses contingent workers because it can hire and fire new staff quickly, with few repercussions. For example, since temporary workers do not expect a long-term relationship with any one employer, the company can terminate employment at any time without causing harm to that employee, as the firm would if it were to lay off a core worker.

Additionally, having contingent workers provides the company with a buffer zone that protects its core workers. That is, in times of economic difficulty the firm always may have a group of contingent workers that it can lay off before reducing the ranks of its core employees. Another issue with improved staffing flexibility is that contingent work allows the company to hire employees who have skills that are not present in their core workforce. This is particularly likely to occur with contract or subcontract employees, who may be hired for a short-term project for which the company has no current staff.

The second major advantage that a firm has when using contingent workers is reduced costs. Contingent workers often are less expensive in terms of salary and benefits (most contingent workers receive no benefits). Additionally, many contingent workers are already trained, and therefore the company does not need to spend money on additional training. Furthermore, because the company only employs these workers when they are needed, there are fewer costs associated with carrying a large labor surplus.

There also are disadvantages associated with using contingent workers. First, many contingent workers lack commitment to the organization when compared to core workers. Contingent workers have a higher turnover rate and also may pose a security risk. Second, while some contingent employees have specialized skills, many are lacking in this regard. Thus, even when hiring from temporary agencies, a company may want to carefully screen temporary employees for needed job skills. A third problem associated with contingent workers is that they are likely to find it difficult to integrate into the company and may suffer from lower morale. Core workers may feel threatened by the presence of contingent employees, resent any lack of skill that they may have, or even overlook them due to their short employment. Thus, core and contingent workers may have more difficulty collaborating.

Historically, temporary employees have been used to substitute for employees who are on leave, to fill in for a short time while the company screens applicants to hire a new core employee, and to expand a company's short-term ability to handle an increased

volume in jobs that are peripheral to core activities. This picture is changing in that, more often, contingent employees are being used in what previously were core organizational jobs. This can have an impact on morale because both contingent and core employees may be working side by side on the same job, but under different compensation and benefits terms. In addition, contingent workers may not get the same training, thereby affecting the risk level in some jobs, such as mining or petrochemical positions.

## REASONS FOR CHOOSING CONTINGENT WORK

While many contingent workers may take contingent work because they prefer it to no work at all, work on a contingent basis may provide a transition to full-time employment and help workers to maintain current skills. However, contingent work may be an individual's preference for a number of reasons. Workers may choose contingent work because of preferences for certain types of work and/or flexible hours. Working parents may wish to schedule work time around child care or school hours. Some professional, technical, and managerial workers may find it advantageous to work on a contract basis. Older workers may wish to keep their earnings within the limit imposed by Social Security legislation. Additionally, some workers may choose contingent work because it provides for change and increased stimulation as they move from job to job.

Because there are many different types of contingent work and many different types of contingent workers, management must pay attention to how contingent work is used in their organization. Additionally, decisions about how to manage contingent workers and whether or not to integrate them into the core employee workforce may have a significant effect on the cost-benefit aspect of the contingent work arrangement.

*SEE ALSO:* Employee Compensation; Employee Recruitment Planning; Employee Screening and Selection; Employment Law and Compliance; Human Resource Information Systems; Human Resource Management

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# CONTINUING EDUCATION AND LIFELONG LEARNING TRENDS

## CONTINUING EDUCATION

Continuing Education, professional development and lifelong learning are all terms used to describe an educational or training process that is a key component for successful organizations. The term Continuing Education often elicits several definitions, however one of the most comprehensive and applicable is Liveright and Haygood's 1969 version, "a process whereby persons who no longer attend school on a regular full-time basis . . . undertake sequential and organized activities with the conscious intention of bringing about changes in information, knowledge undertaking, skill appreciation and attitudes or for the purpose of identifying or solving personal or community problems" (Courtenay, 1990).

Continuing Education and the adult education movement began with the twentieth century. As the world moved to an industrialized economy the need for continued education and improved access for adults challenged traditional educational venues and created opportunities for both professional and personal skill enhancement and enrichment. Several environmental factors are driving the demand for lifelong learning in the twenty-first century: abundant access to information, rapid technology changes, increased global interactions, industry shifts, as well as increasing entry level credentials and skill requirements.

Employers depend on continuing education as a tool for ensuring a highly skilled and knowledgeable workforce. Individuals use continuing education for upward career mobility, job enhancement and personal enrichment.

The Continuing education activity can take place at virtually any time or any place. The format for the continuing education learning should be driven by the content and learning goals. Internet and satellite

technology allow employees to engage in educational coursework on the job or at home, which results in a tremendous savings of travel costs and time. Continuing Education courses are offered for academic or university level credit, as well as non-credit courses. Universities, community colleges, k-12 school districts, private consultants and corporations all participate in offering continuing education content and courses. Many organizations take advantage of "off-the shelf" or commission for customized content that is offered through their own employee training group.

## LIFELONG LEARNING

Throughout the last decade the concept of lifelong learning has continued to gain popularity. Organizations in the twenty-first century are challenged to quickly adapt to industry changes and rapidly identify solutions for obstacles or barriers that the organization encounters. Through the lifelong learning process, individuals develop the capacity for addressing this organizational need. Key characteristics of lifelong learning include duration, learner-centered perspective, multi-level and multi-subject learning, and open access.

The core concept of lifelong learning is that individuals learn from cradle to grave and that each individual progresses from one learning level to the next throughout their lifetime. Each learning event is a continuous progression to the next learning event and never isolated or a means to an end in itself.

Lifelong learning also focuses on the learner rather than an instructor or trainer. The learning process often involves a facilitator but the facilitator should be skilled at providing an educational environment that allows the individual to enhance and engage in his or her own learning objectives. The learning format and content should be designed with the learner in mind. Lifelong learners require choices and educational experiences that fit within their lifestyle. The educational activity should balance the needs and convenience of the organization with individual learner's need in order to maximize the learning outcome. Lifelong learning activities are also designed for multiple learning styles. Experiential and applied learning as well as tutorials and self-directed content are often embraced by lifelong learners.

Lifelong learning encompasses all levels of educational acquisition and in an infinite number of subjects. It includes skill training, credential requirements, as well as social interests. This education may be in the form of formal education or training that is offered both as credit and non-credit in a variety of venues. It also occurs through non-formal means such as libraries, museums, manuals and mentors.

Lifelong learning should be accessible to all individuals regardless of age, race, ability, prior qualifications, workplace role or sociodemographics. Innovative delivery formats help to ensure that the learning activities are accessible to anyone that is interested in participating.

## CONTINUING EDUCATION UNITS AND ACADEMIC CREDIT

Many industry boards, accreditation agencies and associations have established mandatory continuing professional education (CPE) requirements for licensure or certification. For example, the American Institute of Certified Public Accountants (AICPA) has established mandatory continuing professional education (CPE) for all members. Most state boards of accountancy have also phased in mandatory CPE as prerequisites for licensure of accounting and auditing practice units. Research has supported this trend. In an empirical study of the Texas State Board of Public Accountancy, researchers found evidence of an association between results of an employee's quality review and levels of continuing professional education in the profession (Thomas, Davis, and Seaman, 1998). Other organizations have established a certification process for their respective field such as the Society for Human Resource Management (SHRM), which has partnered with educational institutions to deliver the Professional Human Resource Management (PHRM) content and certification test nationally. Non-credit continuing education courses often carry state-board or association Continuing Education Units (CEU). Participants generally receive a certificate of completion and should maintain personal records of the units earned.

Post-secondary higher education also falls within the sphere of Continuing Education. As entry-level requirements continue to increase such as the 150 hour accounting program and demand for graduate level credentials, employers and employees search for flexible degree programs. Many employers offer a tuition reimbursement program for employees enrolled in college level degree programs when applicable to the workplace. Colleges and Universities recognize the growing demand from adult learners for academic degree programs, and many offer academic courses off campus, on-line or at the workplace in accelerated and non-traditional formats.

## CORPORATE UNIVERSITIES

The corporate university is generally some blend of higher education and organizational training and development. "The first corporate colleges appeared almost 80 years ago, but their ranks have grown, relatively speaking by leaps and bounds" (Wilcox, 1987).

Corporate colleges or universities are characterized as institutions that may grant degrees, academic credit or non-credit training and are chartered by a parent company whose primary mission is not education. Some corporate universities have evolved from a mission to serve the corporation's training and development needs to a full-service private higher education institution. Northrop University began in 1942 as a training division of Northrop Aircraft and evolved to an institution offering undergraduate and postgraduate degrees. Kettering Institution (an independent university) grew out of General Motors. Many corporations identify a university or college partner to customize training and academic degree programs specifically to the corporation's business practices. Corporations are using these customized programs as a source for developing future corporate leaders and a means to focus on content areas that are critical to the company's strategic business plans. Multinational companies are developing corporate universities that allow employees around the world to participate in training and educational programs with cost effective delivery methods. The American Council on Education (ACE) consistently evaluates corporate college or university credits that are offered independent of a regionally accredited institution. ACE establishes recommendations for transfer credit to regionally accredited universities and colleges. Most of the individuals participating in corporate college or university programs are employed full-time which requires that the educational programs are offered in flexible formats. Generally, employees do not have the luxury of attending academic programs on a full-time basis or in a traditional fifteen to eighteen week semester format. Accelerated formats as well as weekend and distance education designs address the needs of working adult learners.

## DISTANCE EDUCATION

Distance Education is an all-encompassing phrase for education and training that occurs away from the traditional classroom. Distance Education may occur in synchronous (real) or asynchronous time which allows both employers and learners to determine the best time for participation.

Distance Education began with correspondence study and has grown significantly as technology advancements create new opportunities for learning and content delivery. As computer technology became prevalent in business, the print based correspondence courses progressed to computer based training, which included simulations and ultimately interactive course content that provided participant feedback and enhanced learning. At the end of the twentieth century, educators and employers invested in telecommunication equipment that distributed educational or training activities from one video conferencing site to another. These interactive television programs allow companies to synchronously connect employee groups regardless of their physical distance. The tremendous growth of internet technology has created the most recent version of distance learning which is online or eLearning.

The internet is an information rich resource. Because the internet contains more information than any individual could ever process, it is important that individuals and organizations develop knowledge management strategies to sort, categorize and maximize the benefits the internet's wealth of information. Online learning is one component of knowledge management within the information technology environment.

Online learning content ranges from one-hour courses to complete bachelor, master or doctorate degree programs. Internet delivered courses have the benefits of serving multiple groups at multiple locations without the expense of equipment infrastructure at each location, and the course material can be delivered either synchronously or asynchronously which affords multinational operations the opportunity to connect individuals regardless of time zone or geographical location.

The online training and education market is very competitive offering many choices for organizations and learners. Colleges and Universities throughout the world are offering online courses as well as thousands of training and consulting groups. Organizations either select educational programs and courses ala carte or build a portfolio of eLearning options. Many large organizations have integrated eLearning into their corporate university entity. These groups generally have a planned web presence that includes a portal and learning management system (LMS) or course management system (CMS).

Online learning has created many new products and support options. In addition to the organization's web presence, portal and LMS, the organization also needs to assess the technology infrastructure that supports the eLearning initiative. The fundamental needs in this area are servers that provide redundancy and acceptable uptime. This is often referred to as hosting in the eLearning environment as well as technology support in the form of a help desk. Organizations interested in growing their own portfolio of online learning options should first develop a vision for their eLearning initiative prior to making any financial investments in equipment or software. Once the vision is established the organization should assess their existing technology capabilities and determine if there is capacity to support the eLearning initiative, or is it more cost effective to outsource all or some of the technology infrastructure. When the technology infrastructure has been addressed the organization should determine how content will be developed for the eLearning

environment. Quality online courses are developed so that the technology optimizes the content. Many vendors offer digitized content and others specialize in specific areas of content development such as simulations or multimedia graphics and enhancements. Having a clear vision for the course content and understanding the learning needs will help to ensure that courses are developed efficiently and effectively.

Blended learning refers to online learning that is integrated with traditional classroom or training instruction. This blend provides the benefits of reduced travel costs and time with the positive relational aspects of face-to-face learning. Once an organization or an individual has established a clear vision for their educational needs they should consider all of the available online resources as tools to ensure that the "best fit" is created.

## GLOBAL ECONOMY

The global economy has increased the need for organizations around the world to understand the culture and business practices of their peers, competitors and partners. Both foreign and domestic organizations abroad are implementing continuing education experiences in an effort to enhance cultural understanding and address skill and knowledge gaps. U.S. universities are partnering with both U.S. and foreign companies around the world to deliver educational courses and programs that are critical to organizational competitiveness. A central ministry of education in collaboration with a ministry of commerce generally drives these programs. For instance, China has placed a high priority on the field of Human Resource Development and Entrepreneurship as well as encouraging Chinese organizations to partner with foreign organizations in an effort to implement vocational and applied skill training. India has created a new industry as an outsource venue for customer service which creates customer service training opportunities in India. Korean manufacturers have a solid history of identifying corporate and educational partners that satisfy their organizational educational needs. Continuing Education helps global companies to connect the workforce with the organizational vision.

## THE FUTURE OF CONTINUING EDUCATION

The abundant access of information, rapid technology changes, increased global interactions, industry shifts as well as increasing entry level credentials and skill requirements ensures that Continuing Education will remain a valuable resource for managers in the future.

Managers will continue to depend on continuing education as a tool for ensuring a highly skilled and knowledgeable workforce. Individuals will engage in lifelong learning as a means for upward career mobility, job enhancements and enriched quality of life.

The increased interest in lifelong learning coupled with rapid technology advancements and demands on individual personal time will guarantee that educational options will continue to be flexible and fit within the constraints of personal time and organizational priorities. The growing global economy will continue to drive the development of learning activities that span geographical regions and time zones allowing individuals around the world to collaborate and learn together.

Organizations around the world will depend on continuing education to maintain competitive positions and adopt current innovations. Managers will depend on lifelong learning to produce a workforce with the knowledge and solution based skill-set that is required for organizational growth.

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## CONTINUOUS IMPROVEMENT

Continuous improvement in a management context means a never-ending effort to expose and eliminate root causes of problems. Usually, it involves many incremental or small-step improvements rather than one overwhelming innovation. From a Japanese perspective continuous improvement is the basis for their business culture. Continuous improvement is a philosophy, permeating the Japanese culture, which seeks to improve all factors related to the transformation process (converting inputs into outputs) on an ongoing basis. It involves everyone, management and labor, in finding and eliminating waste in machinery, labor, materials and production methods.

The Japanese word for continuous improvement, *kaizen,* is often used interchangeably with the term *continuous improvement.* From the Japanese character *kai,* meaning change, and the character *zen,* meaning good, taken literally, it means *improvement.*

Although kaizen is a Japanese concept, many U.S. firms have adopted it with considerable success by combining the best of traditional Japanese practices with the strengths of Western business practice, in other words, by merging the benefits of teamwork with the creativity of the individual. Some refer to its implementation in the West as lean manufacturing since, when combined with the principles of just-in-time (JIT), kaizen or continuous improvement forms the foundation for the concept of lean manufacturing.

### HISTORY OF CONTINUOUS IMPROVEMENT

Following the defeat of Japan in World War II, America wanted to encourage the nation to rebuild. As with the Marshall Plan in Europe, General MacArthur asked a number of leading experts from the U.S. to visit Japan and advise them on how to proceed with the rebuilding process. As history would have it, one of these experts was Dr. W. Edwards Deming. Deming was a statistician with experience in census work, so he came to Japan to set up a census. While in Japan, he noticed some of the difficulties being experienced by some of the newly emerging industries. Many Japanese manufacturers were faced with huge difficulties stemming from a lack of investment funds, raw materials, and components, and from the low morale of the nation and the workforce. Based on his recent experience in reducing waste in U.S. war manufacture, he began to offer his advice.

By the mid-1950s, he was a regular visitor to Japan. He taught Japanese businesses to concentrate their attention on processes rather than results; concentrate the efforts of everyone in the organization on continually improving imperfection at every stage of the process. By the 1970s many Japanese organizations had embraced Deming's advice and were very quickly enjoying the benefits of their actions. Most notable is the Toyota Production System, which spawned several business improvement practices utilized heavily in Japan, including JIT and Total Quality Management (TQM).

Despite the fact that much of the foundation of continuous management and other Japanese concepts originated in the U.S., Western firms showed little interest until the late 1970s and early 1980s. By then the success of Japanese companies caused other firms to begin to reexamine their own approaches. Hence, kaizen or continuous management began to emerge in the U.S. concurrent along with the increasing popularity and use of Japanese techniques such as JIT and TQM. In fact, continuous improvement is a major principle of and a goal of JIT, while it is one of the two elements of TQM (the other is customer satisfaction). In some organizations, quality circles have evolved into continuous improvement teams with considerably more authority and empowerment than is typically given to quality circles. In fact, management consultants in the West have tended to use the term *kaizen* to embrace a wide range of management practices primarily regarded as Japanese and responsible for making Japanese companies strong in the areas of continual improvement rather than innovation.

### KAIZEN ATTITUDES NECESSARY FOR IMPLEMENTATION

Most Japanese people are, by nature or by training, very attentive to detail and feel obligated to make sure everything runs as smoothly as possible, whether at work or at home. This attitude enhances the functionality of kaizen. However, this is not typically the case in the West. To encourage the kaizen attitude, organizations require a major change in corporate culture; one that admits problems, encourages a collaborative attitude to solving these problems, delegates responsibility and promotes continuous training in skills and development attitudes.

The driving force behind kaizen is dissatisfaction with the *status quo,* no matter how good the firm is perceived to be. Standing still will allow the competition to overtake and pass any complacent firm. The founder of Honda has been quoted as saying, "In a race competing for a split second, one time length on the finish line will decide whether you are a winner or a loser. If you understand that, you cannot disregard even the smallest improvement." Although continuous improvement involves making incremental changes that may not be highly visible in the short term, they can lead to significant contributions in the long term.

Organizational performance can improve from knowledge gained through experience. Lessons learned from mistakes mean those mistakes are less likely to be repeated, while successes encourage workers to try the same thing again or continue to try new things. While this learning process occurs throughout the system it is particularly important for accomplishing the long-term improvement associated with continuous improvement. In order for continuous improvement to be successful, the organization must learn from past experience and translate this learning into improved performance.

Part of the learning process is trying new approaches, exploring new methods and testing new ideas for improving the various processes. So experimentation can be an important part of this organizational learning. Naturally, many of these worker-led experiments will fail, so it is important to recognize that there is some risk associated with this experimentation. If management is uncomfortable with risk, it may be reluctant to allow any real degree of experimentation. Obviously, management cannot risk disabling the production process itself or endanger the well-being of the workforce, but the complete absence of risk can reduce the vision of those involved in the continuous improvement process. Improvements will generally come in modest increments of progress. Therefore, management must recognize that some experiments will fail as part of the learning process, and avoid the temptation to harshly judge the perpetrator as having new but unsuccessful ideas. Some even feel that it is critical to establish an environment that reinforces the notion that risk is good. Again, this involves consistency in management's attitude toward change and the empowerment of employees.

The achievement of continuous improvement requires a long-term view and the support of top management. But it is also important that all levels of management actively support and become involved in the process. Proper support structures of training, management, resource allocation, measurement, and reward and incentive systems must be in place for successful adoption. This includes a willingness to provide financial support and to recognize achievements. It is desirable to formulate goals with the workers' help, publicize the goals, and document the accomplishments. These goals give the workers something tangible to strive for, with the recognition helping to maintain worker interest and morale.

Kaizen also requires that all employees in the organization be involved in the process. Every employee must be motivated to accept kaizen as a means by which the firm can achieve a competitive advantage in the marketplace. All involved must push continuously at the margins of their expertise, trying to be better than before in every area. Japanese companies have been very successful with the use of teams composed of workers and managers. These teams routinely work together on problem solving. Moreover, the workers are encouraged to report problems and potential problems to the teams; their input is as important as that of management. In order to establish a problem-solving orientation, workers should receive extensive training in statistical process control, quality improvement, and problem solving.

Problem solving is the driving force behind continuous improvement. Actually, it can be said to become a way of life or a culture that must be assimilated into the thinking of management and workers alike. Workers are trained to spot problems that interrupt, or have the potential to interrupt, the smooth flow of work through the system. When such problems do occur, it is important to resolve them quickly. Also, workers are trained to seek improvements in the areas of inventory reduction, set-up time and cost reduction, increasing output rate, and generally decreasing waste and inefficiency.

Unfortunately, workers in a continuous improvement system have more stress than their counterparts in more traditional systems. This stress comes not only from the added authority and responsibility but also from the fast pace inherent in the system. There is little slack built into the system and a continual push to improve. For this reason, firms stressing continuous improvement have suffered severe criticism from some labor unions.

## BENEFITS OF KAIZEN

The benefits of continuous improvement manifest themselves in numerous ways. In an August 2004 article, Perry Flint examined how American Airlines' Tulsa MRO base has seen dramatic improvements after implementing continuous improvement initiatives. The base is the largest such facility in the world with some 8,000 employees and 3 million square feet of docks and shops across 300 acres. Continuous Improvement teams in their components and avionics shop have helped reduce $1.5 million in inventory requirements while freeing 11,600 sq. ft. of shop space; repairing broken cargo door torque tubes in lieu of purchasing a new replacement has resulted in a savings of $250,000 per year; turnaround times for overhauls have improved more than 38 percent, and replacing parts only as needed on the 737NG has resulted in a savings of $100,000.

These improvements have been made possible through employee and union buy-in, the creation of employee-led work teams, and the realized benefits, after implementation, of employee-recommended improvements and streamlined procedures. The employee-driven improvements are integral to the success of the Continuous Improvement process. The changes are not force-fed by management, thus the employees

are less resistant to the changes and recognize the necessity and value in implementing these alternative methods.

A case history of the kaizen training implementation at Pace Micro Technology details the improvements after an update to a continuous improvement program, including an overhaul of intranet support for continuous improvement activities. These improvements resulted in 238 ideas registered on the continuous improvement intranet that were either in action or waiting for teams to begin work, after just nine months. Of those, 39 teams had completed their work and realized a financial benefit of £1.1 million. In addition, there was 71 percent involvement across the organization. Leadership at all levels in the organization has led to the success at Pace, with individuals modeling behaviors, encouraging and enabling others to act, inspiring a shared vision, challenging the status quo and taking risks.

Through kaizen or continuous improvement, firms are able to produce better products and services at lower prices, thus providing greater customer satisfaction. In the long term, the final product will be more reliable, of better quality, more advanced, cheaper and more attractive to customers.

*SEE ALSO:* Japanese Management; Lean Manufacturing and Just-in-Time Production; Quality and Total Quality Management; Quality Gurus; Statistical Process Control and Six Sigma

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## CORPORATE GOVERNANCE

Corporate governance is the responsibility of a firm's board of directors. While management runs the company and oversees day-to-day operations, it is the board of directors that "governs" the corporations by overseeing management and representing the interests of the firm's shareholders.

By law, a corporation of any size must have a board of directors elected by its shareholders. The directors have a fiduciary duty to the shareholders, who are the corporation's owners, and directors as well as corporate officers can be held liable for failing to meet their fiduciary duties to stockholders. A passive board can get into trouble by relying on an influential CEO.

Investors and the public are particularly interested in the financial reports that publicly-traded companies release, and boards of directors of these companies have a legal obligation to ensure that these reports are fair and accurate. Recent business failures, auditor malfeasance, and material deficiencies in financial disclosures, however, have caused a serious erosion of public confidence in the financial reporting of these companies.

Consequently, Congress enacted the Sarbanes-Oxley Act of 2002. Common law has traditionally held that corporate directors have a primary fiduciary duty to the corporation and a secondary duty the shareholders. Sarbanes-Oxley has essentially made directors primarily responsible to the shareholders. The mandates of Sarbanes-Oxley are both complex and extensive. Stated simply, however, they basically require that members of corporate boards must avoid any financial, family, employee, or business relationships with the companies on whose boards they serve.

Further, Sarbanes-Oxley limits the ability of employees of the independent auditing firm from going to work for companies the auditor performs audit services for, and it requires five-year rotation period for audit partners on a given company's assignments. In other words, Sarbanes-Oxley clearly emphasizes independences and avoidance of conflict of interest.

## KEY GOVERNANCE ISSUES

Historically, corporate boards of directors have had a myriad of duties, most of them set by common law and the corporation's own by-laws. These duties often include: hiring, supervising, and sometimes firing the Chief Executive Officer; approving major strategic decisions; meeting with shareholders; establishing executive compensation; making decisions about mergers and acquisitions; assessing the viability of potential takeover bids; taking action if the corporation fails; overseeing financial reporting and audits; nominating board candidates; and refining board rules and policies.

One of the most difficult governance duties of the board of directors is the removal of the firm's CEO. This can occur when the board, representing the interests of the shareholders, disagrees with the strategic direction being pursued by the CEO, or if they merely want to show they are "doing their duty" as board members. For example, when Carly Fiorino was ousted as CEO of Hewlett-Packard (HP) in 2005, she was viewed by many to be hard-driving and fearless. The HP board of directors, however, had grown increasingly uncomfortable with her inability to deliver the profits that she promised she was going to deliver. Her refusal to relinquish some operating control, or to make any changes that the board requested, led to her downfall during a period of low profits and falling stock prices.

One measure of good governance is whether the company has a CEO who can maximize the company's performance. Whereas part of the governance function of the board of directors is to select the firm's CEO, another is to endorse the CEO's strategy—if it is the right one. For example, boards can support the CEO's strategic direction by endorsing proposed acquisitions. It can push the CEO to accomplish even more by encouraging him or her to think more broadly or by setting higher sales targets. The board can also support the CEO's leadership by making sure that the CEO is able to put together a strong management team to achieve those goals. In some cases the following CEO will be recruited from the management team built by the present CEO.

Another difficult time for boards occurs when the firm is the target of a takeover attempt. It is vitally important at such a time that the board have a clear sense of the value of the firm and that it is enabled to fully evaluate takeover offers. During a takeover it is the board's responsibility to accept or reject offers, and in so doing it must represent the shareholders' interests when negotiating the sale of the firm.

## GOVERNANCE COMMITTEES

Boards often administer their governance responsibilities by establishing committees to oversee different areas of concern. Typical committees include audit, nominating, and compensation committees. This is largely in line with U.S. regulatory guidance. On August 16, 2002, the Securities and Exchange Commission (SEC) updated earlier proposals related to corporate governance that would recommend, but not mandate, that boards establish three oversight committees: a nominating committee, a compensation committee, and an audit committee. The SEC recommended that these oversight committees be composed entirely of independent directors.

Each committee oversees a specific area of corporate governance and reports to the full board. The nominating committee's area of oversight consists of issues related to management succession, including the CEO, and to the composition of the board of directors. The compensation committee oversees compensation of the firm's CEO and its officers, as well as director compensation. The audit committee is concerned with the company's financial condition, internal accounting controls, and issues relating to the firm's audit by an independent auditor.

Almost all publicly held corporate entities in the United States have an audit committee. Since 1978, the New York Stock Exchange (NYSE) has required corporations to have audit committees composed entirely of independent outside directors as a condition for being listed. The audit committees of corporate boards of directors are generally expected to serve as watchdogs for the investors and the creditors. Audit committees are expected to protect the interests of both investors and creditors, as well steward corporate accountability. Moreover, audit committees should make sure that management, the internal auditors, and the external auditors understand that the committee will hold them accountable for their actions (and in some cases, inaction).

The independent audit committee plays a key role in stewardship of the corporation it serves. The audit committee should help ensure that the financial statements are fairly stated, the internal controls are operating effectively, management risk is being reduced, and new processes are minimizing risks. Moreover, the audit committee members should be independent of management and maintain a close working relationship with the independent auditors.

In an article in the *Pennsylvania CPA Journal,* author John M. Fleming sets forth the primary responsibilities of the corporate audit committee: (1) Evaluating the processes in place to assess company risks and the effectiveness of internal controls, and assisting management in improving these processes where necessary; (2) monitoring the financial reporting process both internally and externally; and (3) monitoring and evaluating the performance of internal and external auditors.

A board will sometimes establish a fourth committee, the governance committee. The governance

committee is concerned with overseeing how the company is being run, including evaluation of both management and the board of directors. In some cases the nominating committee will evolve into, or function as, a governance committee.

## ACTIVE GOVERNANCE

Historically, corporate boards have been described as either active or passive. Some corporate CEOs relished having what they thought were "rubber stamp" boards of directors who would approve virtually any actions they chose to pursue. Sarbanes-Oxley has dramatically changed that dynamic. Corporate directors must now be much more independent, and their legal liability to shareholders has increased significantly.

One example in which a traditionally "quiet" board stepped up and became more active occurred with the Walt Disney Company. For years, Michael Eisner ruled the Disney empire with an allegedly brutal iron fist. After Roy E. Disney, Walt Disney's nephew, led a shareholder revolt of sorts and complained that investor votes were being ignored or circumvented, the Walt Disney Company board of directors finally decided to step in. In early 2004, the board took the chairmanship away from Eisner after more than 45 percent of votes cast at company's annual meeting opposed his board re-election. It was a resounding vote of no confidence. But the board then chose an Eisner ally, former U.S. Senator George Mitchell, as chairman, over the objections of several larger shareholders. Ironically, a year later, Eisner was easily re-elected to the board, with only 8.6 percent of voters withholding their support for him.

Boards can take simpler steps to ensure they are not passive without voting out the CEO. They can establish a non-executive chairman, a chairperson who is separate from the CEO. The board can also staff all board committees with independent outside directors, except the president and CEO.

## THE ROLE OF INVESTOR ACTIVISM

Finding qualified people to serve on corporate boards of directors can be a challenging task. Corporate board members are learning in the current legal environment that serving on such board is can open them to a wide range of legal liability issues. The reforms of Sarbanes-Oxley and the SEC all seem well-intended, but will they make a difference for board members who get in over their heads or choose to look away?

Many critics argue that the proposed and enacted reforms do little to solve the real problems that exist with corporate boards. For example, one issue that has been repeatedly raised is the fact that corporate boards tend to only meet a couple of times a year. Yet it is further argued that more frequent meetings do little to solve the major problem, which is the fact that most corporate board members do not have enough access to information to fulfill their duties of stewardship to the shareholders.

Another issue that has been raised after continuous corporate failures revolves around the financial knowledge and competence of corporate board members. One proposed reform to remedy this problem has been to offer more generous pay for corporate board members, particularly those who serve on audit committees. The theory behind the increased pay is that it would help attract more chief financial officers and former chief executive officers from major accounting firms to serve on audit committees.

Proponents of such a move argue that former CFOs and CEOs are ideal audit committee members. But, there remains a limited pool of these professionals available to serve on audit committees. Furthermore, increased disclosure requirements are likely to raise liability for individual audit committee members, thus having a negative impact on their willingness to serve. Increased compensation may not persuade highly-qualified potential committee members to accept the burdensome legal responsibility of vouching for a multinational company's complex and intricate accounting system.

Finally, it is important to realize that having the best and most qualified corporate board of directors is no guarantee that financial reporting or other problems will not occur. Many of the corporate failures, large and small, that occur every year have arisen as a result of inattention, reckless disregard, or malfeasance. While some of the new and proposed regulations may address specific issues that have occurred in certain situations, they will never fully compensate for flaws in human nature. Many corporate failures would still have occurred under the new rules set by Congress and the SEC if board members found ways to ignore or circumvent them. As long as human judgment and discretion is permitted to operate within the corporate board function, there is room for error and wrongdoing.

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## CORPORATE SOCIAL RESPONSIBILITY

Corporate social responsibility (CSR) can be defined as the "economic, legal, ethical, and discretionary expectations that society has of organizations at a given point in time" (Carroll and Buchholtz 2003, p. 36). The concept of corporate social responsibility means that organizations have moral, ethical, and philanthropic responsibilities in addition to their responsibilities to earn a fair return for investors and comply with the law. A traditional view of the corporation suggests that its primary, if not sole, responsibility is to its owners, or stockholders. However, CSR requires organizations to adopt a broader view of its responsibilities that includes not only stockholders, but many other constituencies as well, including employees, suppliers, customers, the local community, local, state, and federal governments, environmental groups, and other special interest groups. Collectively, the various groups affected by the actions of an organization are called "stakeholders." The stakeholder concept is discussed more fully in a later section.

Corporate social responsibility is related to, but not identical with, business ethics. While CSR encompasses the economic, legal, ethical, and discretionary responsibilities of organizations, business ethics usually focuses on the moral judgments and behavior of individuals and groups within organizations. Thus, the study of business ethics may be regarded as a component of the larger study of corporate social responsibility.

Carroll and Buchholtz's four-part definition of CSR makes explicit the multi-faceted nature of social responsibility. The economic responsibilities cited in the definition refer to society's expectation that organizations will produce good and services that are needed and desired by customers and sell those goods and services at a reasonable price. Organizations are expected to be efficient, profitable, and to keep shareholder interests in mind. The legal responsibilities relate to the expectation that organizations will comply with the laws set down by society to govern competition in the marketplace. Organizations have thousands of legal responsibilities governing almost every aspect of their operations, including consumer and product laws, environmental laws, and employment laws. The ethical responsibilities concern societal expectations that go beyond the law, such as the expectation that organizations will conduct their affairs in a fair and just way. This means that organizations are expected to do more than just comply with the law, but also make proactive efforts to anticipate and meet the norms of society even if those norms are not formally enacted in law. Finally, the discretionary responsibilities of corporations refer to society's expectation that organizations be good citizens. This may involve such things as philanthropic support of programs benefiting a community or the nation. It may also involve donating employee expertise and time to worthy causes.

### HISTORY

The nature and scope of corporate social responsibility has changed over time. The concept of CSR is a relatively new one—the phrase has only been in wide use since the 1960s. But, while the economic, legal, ethical, and discretionary expectations placed on organizations may differ, it is probably accurate to say that all societies at all points in time have had some degree of expectation that organizations would act responsibly, by some definition.

In the eighteenth century the great economist and philosopher Adam Smith expressed the traditional or classical economic model of business. In essence, this model suggested that the needs and desires of society could best be met by the unfettered interaction of individuals and organizations in the marketplace. By acting in a self-interested manner, individuals would produce and deliver the goods and services that would earn them a profit, but also meet the needs of others. The viewpoint expressed by Adam Smith over 200 years ago still forms the basis for free-market economies in the twenty-first century. However, even Smith recognized that the free market did not always perform perfectly and he stated that marketplace participants must act honestly and justly toward each other if the ideals of the free market are to be achieved.

In the century after Adam Smith, the Industrial Revolution contributed to radical change, especially in Europe and the United States. Many of the principles espoused by Smith were borne out as the introduction of new technologies allowed for more efficient production of goods and services. Millions of people obtained jobs that paid more than they had ever made before and the standard of living greatly improved. Large organizations developed and acquired great power, and their founders and owners became some of

the richest and most powerful men in the world. In the late nineteenth century many of these individuals believed in and practiced a philosophy that came to be called "Social Darwinism," which, in simple form, is the idea that the principles of natural selection and survival of the fittest are applicable to business and social policy. This type of philosophy justified cutthroat, even brutal, competitive strategies and did not allow for much concern about the impact of the successful corporation on employees, the community, or the larger society. Thus, although many of the great tycoons of the late nineteenth century were among the greatest philanthropists of all time, their giving was done as individuals, not as representatives of their companies. Indeed, at the same time that many of them were giving away millions of dollars of their own money, the companies that made them rich were practicing business methods that, by today's standards at least, were exploitative of workers.

Around the beginning of the twentieth century a backlash against the large corporations began to gain momentum. Big business was criticized as being too powerful and for practicing antisocial and anticompetitive practices. Laws and regulations, such as the Sherman Antitrust Act, were enacted to rein in the large corporations and to protect employees, consumers, and society at large. An associated movement, sometimes called the "social gospel," advocated greater attention to the working class and the poor. The labor movement also called for greater social responsiveness on the part of business. Between 1900 and 1960 the business world gradually began to accept additional responsibilities other than making a profit and obeying the law.

In the 1960s and 1970s the civil rights movement, consumerism, and environmentalism affected society's expectations of business. Based on the general idea that those with great power have great responsibility, many called for the business world to be more proactive in (1) ceasing to *cause* societal problems and (2) starting to participate in *solving* societal problems. Many legal mandates were placed on business related to equal employment opportunity, product safety, worker safety, and the environment. Furthermore, society began to expect business to voluntarily participate in solving societal problems whether they had caused the problems or not. This was based on the view that corporations should go beyond their economic and legal responsibilities and accept responsibilities related to the betterment of society. This view of corporate social responsibility is the prevailing view in much of the world today.

The sections that follow provide additional details related to the corporate social responsibility construct. First, arguments for and against the CSR concept are reviewed. Then, the stakeholder concept, which is central to the CSR construct, is discussed. Finally, several of the major social issues with which organizations must deal are reviewed.

## ARGUMENTS FOR AND AGAINST CORPORATE SOCIAL RESPONSIBILITY

The major arguments for and against corporate social responsibility are shown in Exhibit 1. The "economic" argument against CSR is perhaps most closely associated with the American economist Milton Friedman, who has argued that the primary responsibility of business is to make a profit for its owners, albeit while complying with the law. According to this view, the self-interested actions of millions of participants in free markets will, from a utilitarian perspective, lead to positive outcomes for society. If the operation of the free market cannot solve a social problem, it becomes the responsibility of government, not business, to address the issue.

**Exhibit 1**
**Arguments For and Against CSR**

| FOR | AGAINST |
|---|---|
| The rise of the modern corporation created and continues to create many social problems. Therefore, the corporate world should assume responsibility for addressing these problems. | Taking on social and moral issues is not economically feasible. Corporations should focus on earning a profit for their shareholders and leave social issues to others. |
| In the long run, it is in corporations' best interest to assume social responsibilities. It will increase the chances that they will have a future and reduce the chances of increased governmental regulation. | Assuming social responsibilities places those corporations doing so at a competitive disadvantage relative to those who do not. |
| Large corporations have huge reserves of human and financial capital. They should devote at least some of their resources to addressing social issues. | Those who are most capable should address social issues. Those in the corporate world are not equipped to deal with social problems. |

The "competitive" argument recognizes the fact that addressing social issues comes at a cost to business. To the extent that businesses internalize the costs of socially responsible actions, they hurt their competitive position relative to other businesses. This argument is particularly relevant in a globally competitive environment if businesses in one country expend assets to address social issues, but those in another country do not. According to Carroll and Buchholtz, since CSR is increasingly becoming a global concern, the differences in societal expectations around the world can be expected to lessen in the coming years.

Finally, some argue that those in business are ill-equipped to address social problems. This "capability" argument suggests that business executives and managers are typically well trained in the ways of finance, marketing, and operations management, but not well versed in dealing with complex societal problems. Thus, they do not have the knowledge or skills needed to deal with social issues. This view suggests that corporate involvement in social issues may actually make the situation worse. Part of the capability argument also suggests that corporations can best serve societal interests by sticking to what they do best, which is providing quality goods and services and selling them at an affordable price to people who desire them.

There are several arguments in favor of corporate social responsibility. One view, held by critics of the corporate world, is that since large corporations create many social problems, they should attempt to address and solve them. Those holding this view criticize the production, marketing, accounting, and environmental practices of corporations. They suggest that corporations can do a better job of producing quality, safe products, and in conducting their operations in an open and honest manner.

A very different argument in favor of corporate social responsibility is the "self-interest" argument. This is a long-term perspective that suggests corporations should conduct themselves in such a way in the present as to assure themselves of a favorable operating environment in the future. This view holds that companies must look beyond the short-term, bottom-line perspective and realize that investments in society today will reap them benefits in the future. Furthermore, it may be in the corporate world's best interests to engage in socially responsive activities because, by doing so, the corporate world may forestall governmental intervention in the form of new legislation and regulation, according to Carroll and Buchholtz.

Finally, some suggest that businesses should assume social responsibilities because they are among the few private entities that have the resources to do so. The corporate world has some of the brightest minds in the world, and it possesses tremendous financial resources. (Wal-Mart, for example, has annual revenues that exceed the annual GNP of some countries.) Thus, businesses should utilize some of their human and financial capital in order to "make the world a better place."

## THE STAKEHOLDER CONCEPT

According to Post, Lawrence, and Weber, stakeholders are individuals and groups that are affected by an organization's policies, procedures, and actions. A "stake" implies that one has an interest or share in the organization and its operations, per Carroll and Buchholtz. Some stakeholders, such as employees and owners, may have specific legal rights and expectations in regard to the organization's operations. Other stakeholders may not have specific rights granted by law, but may perceive that they have moral rights related to the organization's operations. For example, an environmental group may not have a legal right in regard to a company's use of natural resources, but may believe that they have a moral right to question the firm's environmental policies and to lobby the organization to develop environmentally friendly policies.

All companies, especially large corporations, have multiple stakeholders. One way of classifying stakeholder groups is to classify them as primary or secondary stakeholders. Primary stakeholders have some direct interest or stake in the organization. Secondary stakeholders, in contrast, are public or special interest groups that do not have a direct stake in the organization but are still affected by its operations. Exhibit 2 classifies some major stakeholder groups into primary and secondary categories.

**Exhibit 2**

| | |
|---|---|
| **Primary Stakeholders** | **Shareholders (Owners)** |
| | **Employees** |
| | **Customers** |
| | **Business Partners** |
| | **Communities** |
| | **Future Generations** |
| | **The Natural Environment** |
| **Secondary Stakeholders** | **Local, State, and Federal Government** |
| | **Regulatory Bodies** |
| | **Civic Institutions and Groups** |
| | **Special Interest Groups** |
| | **Trade and Industry Groups** |
| | **Media** |
| | **Competitors** |

Table based on Carroll and Buchholtz, 2003: p. 71

The owners of a firm are among the primary stakeholders of the firm. An organization has legal and moral obligations to its owners. These obligations include, but are not limited to, attempting to ensure that owners receive an adequate return on their investment. Employees are also primary stakeholders who have both legal and moral claims on the organization. Organizations also have specific responsibilities to their customers in terms of producing and marketing goods and services that offer functionality, safety, and value; to local communities, which can be greatly affected by the actions of resident organizations and thus have a direct stake in their operations; and to the other companies with whom they do business. Many social commentators also suggest that companies have a direct responsibility to future generations and to the natural environment.

An organization's responsibilities are not limited to primary stakeholders. Although governmental bodies and regulatory agencies do not usually have ownership stakes in companies in free-market economies, they do play an active role in trying to ensure that organizations accept and meet their responsibilities to primary stakeholder groups. Organizations are accountable to these secondary stakeholders. Organizations must also contend with civic and special interest groups that purport to act on behalf of a wide variety of constituencies. Trade associations and industry groups are also affected by an organization's actions and its reputation. The media reports on and investigates the actions of many companies, particularly large organizations, and most companies accept that they must contend with and effectively "manage" their relationship with the media. Finally, even an organization's competitors can be considered secondary stakeholders, as they are obviously affected by organizational actions. For example, one might argue that organizations have a social responsibility to compete in the marketplace in a manner that is consistent with the law and with the best practices of their industry, so that all competitors will have a fair chance to succeed.

## CONTEMPORARY SOCIAL ISSUES

Corporations deal with a wide variety of social issues and problems, some directly related to their operations, some not. It would not be possible to adequately describe all of the social issues faced by business. This section will briefly discuss three contemporary issues that are of major concern: the environment, global issues, and technology issues. There are many others.

**ENVIRONMENTAL ISSUES.** Corporations have long been criticized for their negative effect on the natural environment in terms of wasting natural resources and contributing to environmental problems such as pollution and global warming. The use of fossil fuels is thought to contribute to global warming, and there is both governmental and societal pressure on corporations to adhere to stricter environmental standards and to voluntarily change production processes in order to do less harm to the environment. Other issues related to the natural environment include waste disposal, deforestation, acid rain, and land degradation. It is likely that corporate responsibilities in this area will increase in the coming years.

**GLOBAL ISSUES.** Corporations increasingly operate in a global environment. The globalization of business appears to be an irreversible trend, but there are many opponents to it. Critics suggest that globalization leads to the exploitation of developing nations and workers, destruction of the environment, and increased human rights abuses. They also argue that globalization primarily benefits the wealthy and widens the gap between the rich and the poor. Proponents of globalization argue that open markets lead to increased standards of living for everyone, higher wages for workers worldwide, and economic development in impoverished nations. Many large corporations are multinational in scope and will continue to face legal, social, and ethical issues brought on by the increasing globalization of business.

Whether one is an opponent or proponent of globalization, however, does not change the fact that corporations operating globally face daunting social issues. Perhaps the most pressing issue is that of labor standards in different countries around the world. Many corporations have been stung by revelations that their plants around the world were "sweatshops" and/or employed very young children. This problem is complex because societal standards and expectations regarding working conditions and the employment of children vary significantly around the world. Corporations must decide which is the responsible option: adopting the standards of the countries in which they are operating or imposing a common standard worldwide. A related issue is that of safety conditions in plants around the world.

Another issue in global business is the issue of marketing goods and services in the international marketplace. Some U.S. companies, for example, have marketed products in other countries after the products were banned in the United States.

**TECHNOLOGY ISSUES.** Another contemporary social issue relates to technology and its effect on society. For example, the Internet has opened up many new avenues for marketing goods and services, but has also opened up the possibility of abuse by corporations. Issues of privacy and the security of confidential information must be addressed. Biotechnology companies face questions related to the use of embryonic stem cells, genetic engineering, and cloning. All of these

issues have far-reaching societal and ethical implications. As our technological capabilities continue to advance, it is likely that the responsibilities of corporations in this area will increase dramatically.

Corporate social responsibility is a complex topic. There is no question that the legal, ethical, and discretionary expectations placed on businesses are greater than ever before. Few companies totally disregard social issues and problems. Most purport to pursue not only the goal of increased revenues and profits, but also the goal of community and societal betterment.

Research suggests that those corporations that develop a reputation as being socially responsive and ethical enjoy higher levels of performance. However, the ultimate motivation for corporations to practice social responsibility should not be a financial motivation, but a moral and ethical one.

*SEE ALSO:* Ethics

*Tim Barnett*

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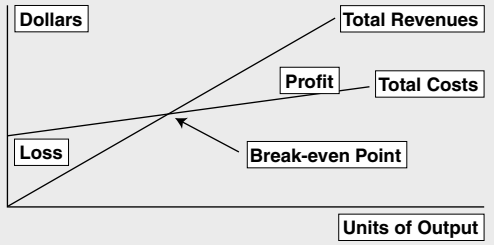
## COST-VOLUME-PROFIT ANALYSIS

Cost-volume-profit (CVP) analysis expands the use of information provided by breakeven analysis. A critical part of CVP analysis is the point where total revenues equal total costs (both fixed and variable costs). At this breakeven point (BEP), a company will experience no income or loss. This BEP can be an initial examination that precedes more detailed CVP analyses.

Cost-volume-profit analysis employs the same basic assumptions as in breakeven analysis. The assumptions underlying CVP analysis are:

1. The behavior of both costs and revenues in linear throughout the relevant range of activity. (This assumption precludes the concept of volume discounts on either purchased materials or sales.)
2. Costs can be classified accurately as either fixed or variable.
3. Changes in activity are the only factors that affect costs.
4. All units produced are sold (there is no ending finished goods inventory).
5. When a company sells more than one type of product, the sales mix (the ratio of each product to total sales) will remain constant.

**Figure 1**
**Cost-Volume-Profit Analysis, Production = Sales**




In the following discussion, only one product will be assumed. Finding the breakeven point is the initial step in CVP, since it is critical to know whether sales at a given level will at least cover the relevant costs. The breakeven point can be determined with a mathematical equation, using contribution margin, or from a CVP graph. Begin by observing the CVP graph in Figure 1, where the number of units produced equals the number of units sold. This figure illustrates the basic CVP case. Total revenues are zero when output is zero, but grow linearly with each unit sold. However, total costs have a positive base even at zero output, because fixed costs will be incurred even if no units are produced. Such costs may include dedicated equipment or other components of fixed costs. It is important to remember that fixed costs include costs of every kind, including fixed sales salaries, fixed office rent, and fixed equipment depreciation of all types. Variable costs also include all types of variable costs: selling, administrative, and production. Sometimes, the focus is on production to the point where it is easy to overlook that all costs must be classified as either fixed or variable, not merely product costs.

Where the total revenue line intersects the total costs line, breakeven occurs. By drawing a vertical line from this point to the units of output (X) axis, one can determine the number of units to break even.

A horizontal line drawn from the intersection to the dollars (Y) axis would reveal the total revenues and total costs at the breakeven point. For units sold above the breakeven point, the total revenue line continues to climb above the total cost line and the company enjoys a profit. For units sold below the breakeven point, the company suffers a loss.

Illustrating the use of a mathematical equation to calculate the BEP requires the assumption of representative numbers. Assume that a company has total annual fixed cost of $480,000 and that variable costs of all kinds are found to be $6 per unit. If each unit sells for $10, then each unit exceeds the specific variable costs that it causes by $4. This $4 amount is known as the unit contribution margin. This means that each unit sold contributes $4 to cover the fixed costs. In this intuitive example, 120,000 units must be produced and sold in order to break even. To express this in a mathematical equation, consider the following abbreviated income statement:

Unit Sales = Total Variable Costs + Total Fixed Costs + Net Income

Inserting the assumed numbers and letting X equal the number of units to break even:

$$\$10.00X = \$6.00X + \$480,000 + 0$$

Note that net income is set at zero, the breakeven point. Solving this algebraically provides the same intuitive answer as above, and also the shortcut formula for the contribution margin technique:

Fixed Costs ÷ Unit Contribution Margin = Breakeven Point in Units

$$\$480,000 \div \$4.00 = 120,000 \text{ units}$$

If the breakeven point in sales dollars is desired, use of the contribution margin ratio is helpful. The contribution margin ratio can be calculated as follows:

Unit Contribution Margin ÷ Unit Sales Price
= Contribution Margin Ratio

$$\$4.00 \div \$10.00 = 40\%$$

To determine the breakeven point in sales dollars, use the following mathematical equation:

Total Fixed Costs ÷ Contribution Margin Ratio
= Breakeven Point in Sales Dollars

$$\$480,000 \div 40\% = \$1,200,000$$

The margin of safety is the amount by which the actual level of sales exceeds the breakeven level of sales. This can be expressed in units of output or in dollars. For example, if sales are expected to be 121,000 units, the margin of safety is 1,000 units over breakeven, or $4,000 in profits before tax.

A useful extension of knowing breakeven data is the prediction of target income. If a company with the cost structure described above wishes to earn a target income of $100,000 before taxes, consider the condensed income statement below. Let X = the number of units to be sold to produce the desired target income:

Target Net Income = Required Sales Dollars
– Variable Costs – Fixed Costs

$$\$100,000 = \$10.00X - \$6.00X - \$480,000$$

Solving the above equation finds that 145,000 units must be produced and sold in order for the company to earn a target net income of $100,000 before considering the effect of income taxes.

A manager must ensure that profitability is within the realm of possibility for the company, given its level of capacity. If the company has the ability to produce 100 units in an 8-hour shift, but the breakeven point for the year occurs at 120,000 units, then it appears impossible for the company to profit from this product. At best, they can produce 109,500 units, working three 8-hour shifts, 365 days per year (3 X 100 X 365). Before abandoning the product, the manager should investigate several strategies:

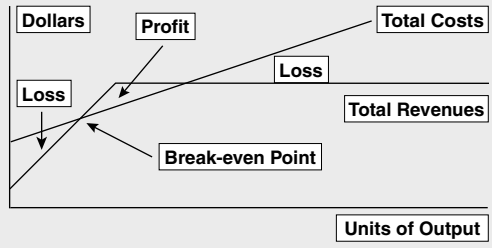
1. Examine the pricing of the product. Customers may be willing to pay more than the price assumed in the CVP analysis. However, this option may not be available in a highly competitive market.
2. If there are multiple products, then examine the allocation of fixed costs for reasonableness. If some of the assigned costs would be incurred even in the absence of this product, it may be reasonable to reconsider the product without including such costs.
3. Variable material costs may be reduced through contractual volume purchases per year.
4. Other variable costs (e.g., labor and utilities) may improve by changing the process. Changing the process may decrease variable costs, but increase fixed costs. For example, state-of-the-art technology may process units at a lower per-unit cost, but the fixed cost (typically, depreciation expense) can offset this advantage. Flexible analyses that explore more than one type of process are particularly useful in justifying capital budgeting decisions. Spreadsheets have long been used to facilitate such decision-making.

One of the most essential assumptions of CVP is that if a unit is produced in a given year, it will be sold in that year. Unsold units distort the analysis. Figure 2 illustrates this problem, as incremental revenues cease while costs continue. The profit area is bounded, as units are stored for future sale.

Unsold production is carried on the books as finished goods inventory. From a financial statement perspective, the costs of production on these units are

deferred into the next year by being reclassified as assets. The risk is that these units will not be salable in the next year due to obsolescence or deterioration.

**Figure 2**
**Cost-Volume-Profit Analysis, Production > Sales**




While the assumptions employ determinate estimates of costs, historical data can be used to develop appropriate probability distributions for stochastic analysis. The restaurant industry, for example, generally considers a 15 percent variation to be "accurate."

## APPLICATIONS

While this type of analysis is typical for manufacturing firms, it also is appropriate for other types of industries. In addition to the restaurant industry, CVP has been used in decision-making for nuclear versus gas- or coal-fired energy generation. Some of the more important costs in the analysis are projected discount rates and increasing governmental regulation. At a more down-to-earth level is the prospective purchase of high quality compost for use on golf courses in the Carolinas. Greens managers tend to balk at the necessity of high (fixed) cost equipment necessary for uniform spreadability and maintenance, even if the (variable) cost of the compost is reasonable. Interestingly, one of the unacceptably high fixed costs of this compost is the smell, which is not adaptable to CVP analysis.

Even in the highly regulated banking industry, CVP has been useful in pricing decisions. The market for banking services is based on two primary categories. First is the price-sensitive group. In the 1990s leading banks tended to increase fees on small, otherwise unprofitable accounts. As smaller account holders have departed, operating costs for these banks have decreased due to fewer accounts; those that remain pay for their keep. The second category is the maturity-based group. Responses to changes in rates paid for certificates of deposit are inherently delayed by the maturity date. Important increases in fixed costs for banks include computer technology and the employment of skilled analysts to segment the markets for study.

Even entities without a profit goal find CVP useful. Governmental agencies use the analysis to determine the level of service appropriate for projected revenues. Nonprofit agencies, increasingly stipulating fees for service, can explore fee-pricing options; in many cases, the recipients are especially price-sensitive due to income or health concerns. The agency can use CVP to explore the options for efficient allocation of resources.

Project feasibility studies frequently use CVP as a preliminary analysis. Such major undertakings as real estate/construction ventures have used this technique to explore pricing, lender choice, and project scope options.

Cost-volume-profit analysis is a simple but flexible tool for exploring potential profit based on cost strategies and pricing decisions. While it may not provide detailed analysis, it can prevent "do-nothing" management paralysis by providing insight on an overview basis.

*SEE ALSO:* Break-Even Point; Cost Accounting

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## COST ACCOUNTING

Cost accounting, often referred to as managerial or management accounting, is the branch of accounting that provides economic and financial information to decision makers within a company. The idea of providing information for use within the company (to aid management to plan, direct, and control operations) differentiates cost accounting from other segments of the accountancy profession. For example, financial accounting serves the public by providing financial reporting via financial statements, financial press releases and such. This public information is prepared and presented based on generally accepted accounting principles (GAAP), the broad rules that assure the user of the underlying framework supporting the information.

On the other hand, cost accounting is limited predominantly to use within the company to aid management in the process of making choices that will benefit the stockholders by maximizing company profits that translate into maximizing stockholder wealth. Since the information is used internally, the information may be presented on any logical basis just so long as it will aid the manager to reach an appropriate, informed decision.

A few concepts in cost accounting, however, form the bridge between financial and managerial accounting topics. One such concept is that of product costing for a manufacturing company. Not only is this information used internally in decision making (e.g., does a company make or buy a component?), product costing is also used to determine the historical basis to account for the cost of products sold during a period and the cost of the unsold inventory that remains as an asset on the statement of financial position at the end of the period.

### OVERVIEW

Numerous cost accounting concepts can benefit management in decision-making, both for manufacturing and service companies. While many of the concepts discussed below are applicable to both types of companies, the basis for ease of discussion will be that of a manufacturing company. Therefore, some of the concepts to be discussed include understanding the distinction between manufacturing and non-manufacturing costs (and how these are disclosed in the financial statements), computing the cost of manufacturing a product (or providing a service), identifying cost behavior in order to utilize cost-volume-profit relationships, setting prices, budgeting and budgetary controls, and capital budgeting. These topics will be briefly discussed below.

### MANUFACTURING VS. NON-MANUFACTURING COSTS

Manufacturing costs are those costs incurred by a producer of goods that are needed to transform raw materials into finished products, ready to sell. These costs consist of the cost of basic materials and components, plus the costs of labor and factory overhead needed to convert the materials into finished products.

Materials and labor can be classified as either direct or indirect in relation to the final product. Direct materials are those major components that can be easily traced to the finished good and are accounted for carefully due to their significance to the product. In the case of manufacturing a lawn mower, for example, these types of materials would include the engine, housing, wheels, and handle. Indirect materials would include those minor items that are essential but which cannot be easily traced to the finished product. Examples of these would be screws, nuts, bolts, washers, and lubricants. One might say that the cost of keeping an account of each of these indirect items exceeds the benefit derived from having the information. Consequently, the costs of these items are accumulated as part of factory overhead and prorated to products on some appropriate basis.

Direct labor refers to the efforts of factory workers that can be directly associated with transforming the materials into the finished product, such as laborers who assemble the product. Indirect laborers are those whose efforts cannot be traced directly or practically to the finished product. The indirect laborers would include maintenance personnel and supervisors.

Factory overhead includes all factory costs that can only be indirectly associated with the finished inventory, that is, all factory costs incurred in making a product other than the costs of direct materials and direct labor. In terms of cost behavior, some of these costs do not change in total even if the number of products manufactured increases or decreases from period to period; the behavior of these costs is said to be a fixed cost. For example, the amount of the monthly factory rent would not fluctuate based on the number of units produced during a particular month.

Other factory overhead costs that change in total in direct proportion to changes in the number of products manufactured are known as variable costs. For example, the number of nuts and bolts needed to assemble lawn mowers would increase and decrease exactly in proportion to the number of mowers produced and are therefore considered to be a variable cost. In summarizing this brief discussion of factory overhead costs, these costs include such things as depreciation of factory buildings and machinery, factory utilities, factory insurance, indirect materials, and indirect labor; some of these costs are variable while others are fixed in total for a specific time period.

All material, labor, and factory overhead costs are summarized into totals that represent the cost of the goods manufactured during a period of time. The cost of products that have been completed and sold during a time period are deducted from the related sales revenue total in order to determine the gross profit for the period. Thus it is logical that these manufacturing costs are referred to as product costs. The cost of unsold completed units at period's end is shown as finished goods on the balance sheet. Any costs of goods that are only partially completed at period's end are shown as work in process inventory, and any materials that have not yet entered into the manufacturing process are disclosed as raw materials inventory.

All the costs incurred by a manufacturing company other than the cost of factory operations are collectively known as non-manufacturing costs. These include all selling, administrative, and financing costs and these costs are deducted as expenses from sales revenues as they are incurred each period. Costs other than manufacturing costs are called period costs for this reason. None of the period costs are deferred to a future period because none of them represent an asset as defined by the accounting profession.

The discussion above has focused on the costs incurred by a manufacturer of goods. The discussion is also pertinent to a business that provides a service to its customers. Providers of services still incur material costs (such as cleaning supplies), labor costs, and general overhead related to providing the services. The major distinction is that, since no tangible product is created, no "product" costs can be deferred to a later period in which they will be sold.

## COMPUTING THE COSTS OF PRODUCING A PRODUCT OR SERVICE

Manufacturing companies use a variety of production processes in creating goods. These processes include job shops, batch flows, machine-paced line flows, worker-paced line flow, continuous flows, and hybrids that consist of more than one of the previous separate flow process. The type of production process to a certain extent determines the type of product costing system that a company utilizes.

Job shops, such as machine shops, receive orders for products that are manufactured to the unique blueprint specifications of the requesting customer. As such, it would be rare for these products to meet the needs of any other customer. Thus each "job" must be accounted for separately as the goods are produced and no goods would be produced on a speculative basis. An appropriate method to determine the cost of each unique item produced is activity-based costing (ABC). This method is discussed in detail elsewhere in this publication; please see Activity-Based Costing. The essence of ABC costing is that the exact costs of materials and labor, and a highly accurate estimate of factory overhead costs based on the specific activities (cost drivers) incurred to produce the goods, are determined for each unique product.

Batch flow processes (such as clothing manufacturers use) and worker-paced line flows (such as found in fast food operations) can both use traditional product costing. This product costing system captures the exact costs of materials and labor while using some predetermined overhead rate to associate an appropriate amount of overhead with each product made. A very common basis for determining the overhead rate is the amount of labor time required to produce each unit of product. To determine the overhead rate, management must first estimate the total overhead costs for the upcoming year. Then an estimate of direct labor hours expected for the same period must be made. Finally the estimated overhead is divided by the estimated total direct labor hours and the resulting overhead rate per hour can be established. As each batch of products is completed and the total direct labor hours used is made known from time cards, the overhead rate is multiplied by the actual hours and the overhead is said to be "applied" to the products.

The traditional product costing method was especially popular in the United States until the mid-1980s when labor costs were still a significant portion of the total cost of products. However, with technological changes (such as computer-integrated manufacturing) and more capital intensive approaches to production (such as robotics), the use of a dwindling labor component of product cost as a basis to apply overhead cost was no longer adequate. This was the impetus for the development of ABC costing mentioned above.

Machine-paced line flow processes (such as used by automobile manufacturers) lend themselves to process cost accounting. In this system of product costing, products' costs are accumulated during each of the numerous processes through which the products flow. In the case of an automobile manufacturer, some of the processes might include subassembly stations that reside offline from the main conveyor system

where engine assembly, dashboard assembly and the like occur. These major components and their related material, labor, and overhead costs are then carried forward to the next process and new material, labor, and overhead costs are added in each successive process until completion. Thus the individual costs incurred in each process and the total costs incurred are available for financial statements and decision-making purposes.

Companies that use a continuous flow process of production, such as a paper manufacturing company that operates 24/7, would likely use a standard costs system. This product costing system not only accumulates the actual costs incurred in manufacturing the product, but it also determines the standard costs that should have been incurred (based on predetermined standards for material, labor, and factory overhead). By allowing comparisons between actual and standard totals, any discrepancy or variance can be noted and investigated. In particular, any unfavorable costs being incurred can be corrected in a timely manner.

## COST BEHAVIOR

One of the critical steps in decision-making is the estimation of costs to be incurred for the particular decision to be made. To be able to do this, management must have a good idea as to how costs "behave" at different levels of operations; i.e., will the cost increase if production increases or will the cost remain the same? A common use of cost behavior information is the attempt by management to predict the total production costs for units to be manufactured in the upcoming month. There are several methods used to estimate total product costs: the high-low method, a scatter-graph, and least-squares regression. Each of these methods attempts to separate costs into components that remain constant (fixed) in total regardless of the number of units produced and those that vary in total in proportion to changes in the number of units produced. Once the behavior of costs is known, predictive ability is greatly enhanced.

Use of the high-low method requires the use of only two past data observations: the highest level of activity (such as the number of units produced during a time period) and the associated total production cost incurred at that level, and the lowest level of activity and its associated cost. All other data points are ignored and even the two observations used must represent operations that have taken place under normal conditions. The loss of input from the unused data is a theoretical limitation of this method.

The scatter-graph method requires that all recent, normal data observations be plotted on a cost (Y-axis) versus activity (X-axis) graph. A line that most closely represents a straight line composed of all the data points should be drawn. By extending the line to where it intersects the cost axis, a company has a fairly accurate estimate of the fixed costs for the period. The angle (slope) of the line can be calculated to give a fairly accurate estimate of the variable cost per unit. The inclusion of the effect of all data points is a strength of this method, but the unsophisticated eyeballing of the appropriate line is a weakness.

The most robust method is the least-squares regression method. This method requires the use of thirty or more past data observations, both the activity level in units produced and the total production cost for each. This technique is known for its statistical strengths but its sophistication requiring the use of software packages can be a hindrance.

For a more detailed description of how the high-low method, a scatter-graph, and least-squares regression aid in separating costs into fixed and variable components, see Cost-Volume-Profit Analysis elsewhere in this publication. Included therein is also a discussion of break-even analysis, contribution margin, and profit/loss projections using cost behavior estimates.

Assuming that a company has used one of the techniques above and has separated costs of manufacturing its products into fixed and variable components, it can use the following general model and substitute derived fixed and variable amounts to create a specific model:

General Model: Total Cost = Fixed Costs for a Month
+ Variable Cost per Unit
Specific Model: Total Cost Expected = $10,000 per Month
+ $5.00 per Unit

Given this specific model, a prediction can easily be made of the total costs expected when any number of units are budgeted, as long as the number of units far within the normal range of operations for the company. For example, if 5,000 units are budgeted for the next month's production, the total expected cost would be:

$10,000 + $5.00 (5,000) = Total Cost = $35,000

If the cost separation technique is fairly accurate, we are in a position to review whether actual costs are in line with our projected cost. Any significant variation between anticipated cost and actual costs should be investigated. The identification of any variances does not answer any questions; the variances merely note that investigation to ascertain the answers is needed.

One other idea is worth mentioning. Considering total production costs in the example above, the same techniques used to separate total costs into fixed and variable components can be utilized to separate any individual cost that isn't readily identifiable as being fixed or variable. A company could, for instance, take the past monthly factory electrical utility bills or the sales wages and use any of the three techniques to

separate this individual cost into its fixed and variable components.

## SETTING PRICES

Setting the price for goods and services involves an interesting interaction of several factors. The price must be sufficient to exceed the product and period costs and earn a desirable profit. For normal sales to external customers, most companies are unable to unilaterally set prices. Prices are typically set in these competitive markets by the laws of supply and demand. However, if a company manufactures a product unique to customer specifications, or if the company has a patent to its product, then the company can set its own price. One approach to accomplish this is cost-plus pricing. As discussed above, the company must have knowledge of the costs that it will incur. Then the company can apply the proper markup, given the competitive market conditions and other factors, to set its target-selling price.

Some companies add their markup to their variable costs, rather than using the full cost needed for cost-plus pricing. Variable cost pricing is especially useful in special instances such as in pricing special orders or when the company has excess capacity. In both of these cases, production and sales at normal prices to regular customers will be sufficient to cover the total fixed and variable costs for typical sales levels and the concern is only for the incremental units above normal sales levels.

Nissan Motors and other automobile manufacturers take what might be considered a "backward" approach to setting the prices of their vehicles relative to their expected costs. This approach is known as target costing. Once these companies determine what type of vehicle and market niche they wish to pursue, they test the market to see what "target price" the market will bear for their vehicle. From this number they deduct their "desired profit" in order to determine the "target cost" for their product. Then they gather the experts needed to ascertain if they will be able to produce the vehicle for this targeted cost.

If a company has two or more divisions and the output of one division can be used as input to a subsequent division, a price can be set for "sale" from one division to the next in order to measure profitability for each division. This internal transfer price should be set so as to encourage division managers to purchase and sell internally, thus maximizing overall company profits. Transfer prices can be determined based on negotiations between the affiliated divisions, based on the existence of excess capacity by the producing division, based on marking up the variable cost of the goods sold internally, or based on market prices for similar goods, and other approaches.

## BUDGETING AND BUDGETARY CONTROLS

Managers use budgets to aid in planning and controlling their companies. A budget is a formal written expression of the plans for a specific future period stated in financial terms. Jerry Weygandt, Donald Kieso and Paul Kimmel's book,*Managerial Accounting: Tools for Business Decision Making* lists the following benefits of budgeting:

1. It requires all levels of management to plan ahead and formalize goals on a repetitive basis.
2. It provides definite objectives for evaluating performance at each level of responsibility.
3. It creates an early warning system for potential problems so that management can make changes before things get out of hand.
4. It facilitates the coordination of activities within the company by correlating segment/division goals with overall company goals.
5. It results in greater management awareness of the company's overall operations including the impact of external factors such as economic trends.
6. It motivates personnel throughout the company to meet planned objectives.

The master budget is the set of interrelated budgets for a selected time period. The specific parts to the master budget are the operating budgets and the financial budgets. The operating budgets begin with a sales budget derived from the sales forecasts provided by the marketing department, followed by the related unit production budget with detail budgets for direct materials, direct labor, and factory overhead. Finally a budget for selling and administrative expenses provides the final information needed for a budgeted income statement. The financial budgets, based on data from the budgeted income statement, are composed of a cash budget, a budgeted balance sheet, and a budget for capital expenditures.

Budgetary control is the process of comparing actual operating results to planned operating results and thereby identifying problem areas in order to take corrective actions. A starting point in this effort is the conversion of the master budget (determined at the start of the period and based on the most probable level of operations) into a flexible budget for the actual level of operations attained. Developing a flexible budget requires identifying the variable costs and the fixed costs for the period as discussed above. Once these cost behavior determinations have been made, total variable costs for the actual level of operations and the total fixed costs for the period can be combined

into a flexible budget that discloses the costs that should have been incurred for the actual level of operations achieved.

In taking corrective actions, one must be aware of whether or not a manager is responsible for a particular cost that has been incurred. While all costs are controllable at some level of responsibility within a company, only the costs that a manager incurs directly are controllable by them. Any costs that are allocated to the manager's responsibility level are non-controllable at the manager's level.

The information above focused on budgetary controls for total costs, including product costs for units being produced and sold, general and administrative expenses, selling expenses, and any financial expenses incurred during the period. When considering comparing actual to standard costs for material, labor, and factory overhead costs, the use of a standard product costing system is needed to provide the detail to analyze each separate product cost component.

## CAPITAL BUDGETING

Companies with excess funds must make decisions as to how to invest these funds in order to maximize their potential. The choices that involve long-term projects require the use the technique of capital budgeting, that is, choosing among many capital projects to find those that will maximize the return on the invested capital. Several methods of capital budgeting are available to management; among these are the payback period method, the net present value method, and the internal rate of return method. All of these methods require the use of estimated cash flow amounts.

The payback period method is especially simple if future inflows from the project being considered happen to be equal in amount each year. In this case, the formula for computing the payback period is:

Cost of Capital Project ÷ Net Annual Cash Inflow = Payback Period

If the project has uneven cash flows, creating a table with a cumulative net cash flow column will identify the year and an estimate of the portion of a year in which the project recoups its cost. A weakness of this method is that it does not consider the time value of money over the life of the project. However, the shorter the payback period is, the sooner the project's cost is recovered and the more attractive the project is.

A strength of the net present value method is that it uses the same cash flow information as described above and it requires that each cash flow be discounted by an appropriate discount rate to allow for the time value of money. The appropriate discount rate could be the company's weighted average cost of capital or its required rate of return. After each cash inflow has been discounted to the point in time at which the investment is made, the total of the discounted cash inflows is compared to the cost of the capital project. If the present value of the net cash inflows equals the cost of the investment in the project, then the project is earning exactly the interest rate chosen for discounting. The exact discount rate at which the two values are equal is known as the internal rate of return. If the present value of the net cash inflows exceeds the cost of the capital project, the project is earning more than the discount rate. If the cost of the capital project exceeds the present value of the net cash inflows, that is, the net present value is negative; then the project is not earning at least the discount rate. While the project is profitable if the cash inflows exceed the cash outflows, it would be rejected since it is not earning the return that is needed.

Modern management theory stresses that setting and reaching goals requires that test readings and adjustments along the way are essential. The recent period of increased international competition has led to the need for cost cutting; some companies have been successful by downsizing, expanding globally, and capturing long-term contracts to minimize the increase in costs. Cost accounting can greatly benefit management by providing product or service cost information for use in planning, directing, and controlling the operations of the business.

*SEE ALSO:* Activity-Based Costing; Cost-Volume-Profit Analysis; Financial Ratios

*John M. Alvis*

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## COVER LETTER TRENDS

*SEE:* Resumes and Cover Letter Trends

## CREATIVITY

Creativity is an imaginative process that results in the creation of something new, be it a product, a service, or a technique. In his book *Managing Creativity,* John J. Kao of Harvard Business School observes that creativity is "a human process leading to a result which is novel (new), useful (solves an existing problem or satisfies an existing need), and understandable (can be reproduced)."

Creativity involves the merging or synthesis of differing concepts into a new concept that did not previously exist. Because creativity reflects the process of integrating diversity into new realities, many researchers have been interested in the skills necessary to be creative in one's work. Personality characteristics associated with people who are creative in nature include: openness to experience; being able to see things in unusual ways; curiosity; the ability to accept and reconcile apparent opposites; having a high tolerance for ambiguity; possessing an independence in thought and action; needing and assuming autonomy or self-reliance; a healthy level of nonconformity; a risk-taking orientation; persistence; sensitivity to problems; the ability to generate large numbers of ideas; flexibility; openness to unconscious phenomena; freedom from fear of failure; the ability to concentrate; and imagination. All of these skills reflect the complexity of trying to measure and predict the creative process. It is a multidimensional and often complex phenomenon that does not easily lend itself to social scientific investigation.

Many management scholars and social observers have argued that in order to stay on the cutting edge of an industry, companies must be able to respond quickly to market opportunities and threats, utilize the ideas of their people more comprehensively, and create new products and services more quickly and efficiently. All of these conditions require the creation of new ways of doing things within the company. Thus, some observers have argued that companies need to develop cultures that foster creativity rather than suppress it. Although this argument has been made by many management scholars since World War II, during the 2000s the rapid pace of technological change within the business world made the issue more cogent than in previous decades. In fact, an American Management Association survey of 500 CEOs, reported in *Psychology Today,* selected "practice creativity and innovation" as the top factor in ensuring corporate survival during the twenty-first century.

Kao notes that, in order to understand how to develop creativity in organizations, it is sometimes useful to study how *not* to facilitate creativity in organizations. He finds that the following organizational norms/behaviors suppress organizational creativity:

- Emphasizing bureaucratic structures and attitudes
- Requiring that decisions must always be made based on organizational tradition and culture
- Continually stressing the importance of standard operating procedures
- Suppressing people who attempt to be creative
- Blocking the flow of ideas with poor internal communication systems
- Tightly controlling systems that eliminate the slack necessary for unofficial initiatives
- Enforcing strict penalties for failure
- Omitting rewards for success
- Promoting values that inhibit risk taking and questioning
- Watching creative activity closely
- Emphasizing tight deadlines
- Stressing authority over responsibility

How, then, can managers foster creativity in the workplace? It requires an approach to managing that many managers find counterintuitive, and that goes against many values in traditional corporate cultures. Kao offers the following as requirements for enhancing creativity in organizations:

- Decentralizing organizational structure
- Promoting a culture that values creative experimentation
- Providing resources to new initiatives
- Encouraging experimental attitudes
- Providing the freedom to fail
- Ensuring that new ideas are not killed
- Removing bureaucracy from the resource allocation process
- Providing appropriate financial and nonfinancial rewards for success
- Encouraging risk taking and questioning

- Minimizing administrative interference in new initiatives and ideas
- Freeing the creative process from surveillance and evaluation
- Loosening deadlines

Managing creativity does not involve anarchy. Rather, it requires that organizational control systems—culture, norms, policies, programs, and reward systems—are loose enough to allow creativity to germinate and grow, while at the same time providing enough structure and overall control to ensure that the organization runs smoothly on a day-to-day basis.

In their article for *Psychology Today,* Stanley S. Gryskiewicz and Robert Epstein termed the optimal environment for organizational creativity "positive turbulence." The authors wrote: "The paradox of positive turbulence is one business leaders today cannot afford to ignore. The energizing, disparate, invigorating, unpredictable force that often feels like chaos is the same creative energy that can provide continuous success and organizational renewal. Without such risk-taking, without embracing uncertainty, many of today's leading businesses will be tomorrow's failures."

Gryskiewicz and Epstein describe sources of positive turbulence—which have the potential to help employees expand their horizons and gain a new perspective on their work—both within and outside of the company. Internal sources of positive turbulence include foreign assignments, cross-functional teams, and cross-generational teams. External sources of positive turbulence include conferences and training sessions, museum and gallery visits, presentations by outside experts, reading outside periodicals, and forging joint ventures and alliances.

In addition, Gryskiewicz and Epstein recommend a number of games and activities to stimulate creativity and innovation. These exercises are intended to develop four basic skills that employees need in order to express their creativity: capturing (noticing and preserving new ideas); challenging (looking beyond established ways of doing things and seeking out difficult problems); broadening (looking beyond one's area of expertise in order to make unusual connections); and surrounding (creating a diverse and interesting work environment).

*SEE ALSO:* Group Decision Making; Innovation

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*Revised by Laurie Hillstrom*

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## CRITICAL PATH METHOD

*SEE:* Program Evaluation and Review Technique and Critical Path Method

## CULTURE—INTERNATIONAL DIFFERENCES

*SEE:* International Cultural Differences

## CULTURE—ORGANIZATIONAL

*SEE:* Organizational Culture

## CUSTOMER RELATIONSHIP MANAGEMENT

Customer relationship management (CRM) is a combination of organizational strategy, information systems, and technology that is focused on providing better customer service. CRM uses emerging technology that allows organizations to provide fast and effective customer service by developing a relationship with each customer through the effective use of customer database information systems. The objectives of CRM are to acquire new customers, retain the right

current customers, and grow the relationship with an organization's existing customers. An integrated business model that ties together technology, information systems, and business processes along the entire value chain of an organization is critical to the success of CRM.

CRM can also be considered a corporate strategy because it is a fundamental approach to doing business. The goal is to be customer-focused and customer-driven, running all aspects of the business to satisfy the customers by addressing their requirements for products and by providing high-quality, responsive customer service. Companies that adopt this approach are called customer-centric, rather than product-centric.

To be customer-centric, companies need to collect and store meaningful information in a comprehensive customer database. A customer database is an organized collection of information about individual customers or prospects. The database must be current, accessible, and actionable in order to support the generation of leads for new customers while supporting sales and the maintenance of current customer relationships. Smart organizations are collecting information every time a customer comes into contact with the organization. Based on what they know about the individual customer, organizations can customize market offerings, services, programs, messages, and choice of media. A customer database ideally would contain the customer's history of past purchases, demographics, activities/interests/opinions, preferred media, and other useful information. Also, this database should be available to any organizational units that have contact with the customer.

CRM has also grown in scope. CRM initially referred to technological initiatives to make call centers less expensive and more efficient. Now, a lot of organizations are looking at more macro organizational changes. Organizations are now asking how they can change their business processes to use the customer data that they have gathered. CRM is changing into a business process instead of just a technology process.

## EVOLUTION OF CRM

Although there are now many software suppliers for CRM, it began back in 1993 when Tom Siebel founded Siebel Systems Inc. Use of the term CRM is traced back to that period. In the mid-1990s CRM was originally sold as a guaranteed way to turn customer data into increased sales performance and higher profits by delivering new insights into customer behaviors and identifying hidden buying patterns buried in customer databases. Instead, CRM was one of the biggest disappointments of the 1990s. Some estimates have put CRM failure rates as high as 75 percent. But more than a decade later, more firms in the United States and Europe are appearing willing to give CRM another try. A 2005 study by the Gartner Group, found 60 percent of midsize businesses intended to adopt or expand their CRM usage over the next two years. Why the interest? Partially the renewed interest is due to a large number of CRM vendors that are offering more targeted solutions with a wider range of prices and more accountability.

Even though CRM started in the mid-1990s, it has already gone through several overlapping stages. Originally focused on automation of existing marketing processes, CRM has made a major leap forward to a customer-driven, business process management orientation.

The first stage began when firms purchased and implemented single-function client/server systems to support a particular group of employees such as the sales force, the call center representatives, or the marketing department. CRM initially meant applying automation to existing marketing activities and processes. However, automating poorly performing activities or processes did little to improve the quality of the return on investment.

In the second stage, organizations demanded more cross-functional integration to create a holistic view of their customers' relationships. Also, the integrated system's goal was to provide a single-face to the customer by enabling employees to work from a common set of customer information gathered from demographics, Web hits, product inquiries, sales calls, etc. Cross-functional integration allowed the whole organization to take responsibility for customer satisfaction and allowed for better predictive models to improve cross-selling and improved products and delivery options.

The third stage of CRM was heavily influenced by the Internet. Customer self-service and Internet-based systems became the next big thing in CRM. However, there were obstacles caused by a lack of seamless integration into the organization's operational systems and a lack of integration across customer touch points such as call centers, web transactions, and other various interactions. By rethinking the quality and effectiveness of customer-related processes, many organizations began to eliminate unnecessary activities, improve outdated processes, and redesign systems that had failed to deliver the desired outcomes. In this stage, the big CRM vendors used new Internet-based systems to extend the reach of CRM to thousands of employees, distribution partners, and even the customers themselves. Also, most organizations at this stage tie together their CRM systems with their ERP (Enterprise Resource Planning) system and other organizational operational systems.

The next stage of CRM will be when systems are designed based on what matters most to the customer

and customers will have direct access to all of the information they need in order to do business with an organization. Customer driven CRM means that organizations first understand the customer, and then move inward to operations. The next generation of CRM will also focus more on financial results. Not all customer relationships are profitable and very few companies can afford to deliver an equal level of services to all customers. Organizations must identify existing profitable customer segments and develop the business requirements to support sustained relationships with these profitable segments. However, organizations also need to find cost effective alternatives for current non-buyers or low-margin customers.

## PROBLEMS WITH CRM

One of the major problems with CRM is the large investment to build and maintain a customer database which requires computer hardware, database software, analytical programs, communication links, and skilled personnel. Also, there is the difficulty of getting everyone in the organization to be customer oriented and to get everyone to actually use the customer information that is available. Providing adequate training so that personnel feel comfortable using a new system is critical. Also, not all customers want a relationship with the company and some may resent the organization collecting information about them and storing it in a database. Another problem is the long wait for a return on investment. A three-year wait for ROI is still common. Research conducted by Helms in 2001 suggests that 45 percent of companies are unable to even compute ROI from their CRM investments and research conducted by Cap Gemini Ernst and Young (CGEY) found that two-thirds of companies could not provide any estimate of their ROI on CRM investments.

## HOW TO SUCCEED WITH CRM

CRM projects require careful planning and implementation. To be successful, CRM involves major cultural and organizational changes that will meet with a lot of resistance. CRM should be enterprise-wide in scale and scope. However, it is usually better to take an incremental approach starting with a CRM pilot. Once the pilot succeeds, then introducing one CRM application at a time is recommended. Also, it is important to be skeptical of vendor claims and to know that user expectations for CRM are often unreasonable.

*SEE ALSO:* Marketing Communication; Strategy Implementation

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# CYCLE TIME

Time has become a key success measure in business. Oftentimes, it is more important than other performance measures. For example, in marketing a product's success or failure often depends on "time-to-market," or how quickly a new product becomes available to the customer. One of many cycle time measures used in management, cycle time is the measure of a

business cycle from beginning to end. Production cycle time refers to production activities, such as the total time required to produce a product. Order processing cycle time is used in the front office to determine the total time required to process an order. From a financial perspective, terms like cash-to-cash cycle time describe the amount of time a company takes to recover its financial investment. From a management perspective, cycle time is used to evaluate performance in all aspects of a business.

Cycle time has become the key measurement tool for the performance of a number of leading edge management concepts, including supply chain management (SCM), just-in-time (JIT) management, enterprise resources planning (ERP), theory of constraints management, and lean management. Cycle time improvements in any of these areas have been linked to reduced costs, reduced inventories, and increased capacity. The resource areas that are measured by cycle time include the measurement of financial flow, materials flow, and information flow. In each case, a delay or failure of any of these measures would indicate a failure of the entire business process.

Cycle time is best illustrated by a few examples. In marketing, time-to-market cycle time is the critical measure of success in the fashion, apparel, and technology industries. Companies that cannot get products to market quickly may get completely washed out. Time-to-market is the measure of time from idea inception through idea development, design and engineering, pilot, and finally production and customer availability. For example, the United States led the world in the idea phase of automotive air bag development. However, a slow design and engineering process enabled the Japanese to generally offer airbags in their vehicles several years before the United States.

Another example of cycle time is the production cycle time. This is the time from when an order is released on the production floor until completion and shipment to the customer. For the American automobile manufacturer this time is measured in weeks and, in some cases, months. For Toyota this time is approximately four hours. The repercussions for this are found is the staging of enormous amounts of work-in-process inventories. The actual "hands-on" production time in both cases is about the same. However, since the United States produces in large batch quantities, it effectively produces hundreds and thousands of cars at the same time. As a result, there is a lot of inventory staging and related work space requirements. This example illustrates the direct relationship between cycle time and inventory.

Another example of cycle time is order-processing time. Unfortunately, in far too many factories the paperwork time to process an order is longer than product production time. Order processing time starts when a phone call or fax initiates the order, and ends when the order is sent to production scheduling. This cycle time includes all paperwork-related steps, such as credit verification and order form completion.

In finance, performance measures such as cash-to-cash cycle time reflect a company's cash performance. This is the amount of time it takes from the time money is spent on a customer's product for the purchase of components until the "cash" is recovered from the customer in the form of a payment. In the computer industry the industry average cash-to-cash cycle time is 106 working days. For "best-in-class" companies this cash-to-cash cycle time is 21 working days, and for Dell Inc. it is a negative seven days. This example illustrates that the average computer company needs to finance its inventory investment for 106 days, whereas Dell has the advantage of being able to utilize its customers' cash to earn interest. Dell can then use this advantage to offer price incentives that the other computer manufacturers cannot.

A variant use of the term "cycle time" is found in industrial engineering. In this specific example, cycle time has a number of meanings—depending on the situation in which the term is used and the industry to which it is applied. It generally is considered to be a manufacturing term applied to an environment where a series of activities or tasks (each with a predetermined completion time known as task time) are performed in a specified sequence known as a "precedence relationship." However, the term can be used in the service sector if the rendering of the service requires a sequential series of tasks. As these tasks are completed at each operation or workstation, the product is passed on to the next workstation in the sequence until the product is complete and can be defined as a finished good.

The predetermined task times govern the range of possible cycle times. The minimum cycle time is equal to the longest task time in the series of tasks required to produce the product, while the maximum cycle time is equal to the sum of all the task times required for a finished good. For example, consider a product that requires five sequential tasks to manufacture. Task one takes 10 minutes to complete; task two, 12 minutes; task three, 20 minutes; task four, 8 minutes; and task five, 10 minutes. The minimum cycle time for this product would be 20 minutes (the longest time). Any cycle time less than 20 minutes would not allow the product to be made, because task three could not be completed. The maximum cycle time would be 60 minutes, or the sum of all task times in the sequence. This implies a range of possible cycle times of 20 to 55 minutes. However, the maximum cycle time would really only be feasible if there was no waste or non-value-added time in the process, such as delays between tasks. Some people refer to the sum of the task times

as throughput time or the time required to move a product completely through the system.

However, in its more general usage cycle time is how long it takes for material to enter and exit a production facility. Depending on the industry, this definition is appropriate with slight modifications. For example, in the automobile collision repair industry cycle time refers to the time a car enters the facility for repair until the repair is completed.

*SEE ALSO:* Operations Management; Operations Scheduling

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# D

## DATA PROCESSING AND DATA MANAGEMENT

Data processing and data management are critical components of business organizations.

### DATA PROCESSING

Data processing refers to the process of performing specific operations on a set of data or a database. A database is an organized collection of facts and information, such as records on employees, inventory, customers, and potential customers. As these examples suggest, numerous forms of data processing exist and serve diverse applications in the business setting.

Data processing primarily is performed on information systems, a broad concept that encompasses computer systems and related devices. At its core, an information system consists of input, processing, and output. In addition, an information system provides for feedback from output to input. The input mechanism (such as a keyboard, scanner, microphone, or camera) gathers and captures raw data and can be either manual or automated. Processing, which also can be accomplished manually or automatically, involves transforming the data into useful outputs. This can involve making comparisons, taking alternative actions, and storing data for future use. Output typically takes the form of reports and documents that are used by managers. Feedback is utilized to make necessary adjustments to the input and processing stages of the information system.

The processing stage is where management typically exerts the greatest control over data. It also is the point at which management can derive the most value from data, assuming that powerful processing tools are available to obtain the intended results. The most frequent processing procedures available to management are basic activities such as segregating numbers into relevant groups, aggregating them, taking ratios, plotting, and making tables. The goal of these processing activities is to turn a vast collection of facts into meaningful nuggets of information that can then be used for informed decision making, corporate strategy, and other managerial functions.

**DATA AND INFORMATION.** Data consist of raw facts, such as customer names and addresses. Information is a collection of facts organized in such a way that it has more value beyond the facts themselves. For example, a database of customer names and purchases might provide information on a company's market demographics, sales trends, and customer loyalty/turnover.

Turning data into information is a process or a set of logically related tasks performed to achieve a defined outcome. This process of defining relationships between various data requires knowledge. Knowledge is the body or rules, guidelines, and procedures used to select, organize, and manipulate data to make it suitable for specific tasks. Consequently, information can be considered data made more useful through the application of knowledge. The collection of data, rules, procedures, and relationships that must be followed are contained in the knowledge base.

**CHARACTERISTICS OF VALUABLE INFORMATION.** In order for information to be valuable it must have the following characteristics, as adapted from Ralph M. Stair's book, *Principles of Information Systems:*

1. Accurate. Accurate information is free from error.
2. Complete. Complete information contains all of the important facts.

3. Economical. Information should be relatively inexpensive to produce.
4. Flexible. Flexible information can be used for a variety of purposes, not just one.
5. Reliable. Reliable information is dependable information.
6. Relevant. Relevant information is important to the decision-maker.
7. Simple. Information should be simple to find and understand.
8. Timely. Timely information is readily available when needed.
9. Verifiable. Verifiable information can be checked to make sure it is accurate.

## DATA MANAGEMENT

Data are organized in a hierarchy that begins with the smallest piece of data used by a computer—for purposes of this discussion, a single character such as a letter or number. Characters form fields such as names, telephone numbers, addresses, and purchases. A collection of fields makes up a record. A collection of records is referred to as a file. Integrated and related files make up a database.

An entity is a class of people, objects, or places for which data are stored or collected. Examples include employees and customers. Consequently, data are stored as entities, such as an employee database and a customer database. An attribute is a characteristic of an entity. For example, the name of a customer is an attribute of a customer. A specific value of an attribute is referred to as a data item. That is, data items are found in fields.

The traditional approach to data management consists of maintaining separate data files for each application. For example, an employee file would be maintained for payroll purposes, while an additional employee file might be maintained for newsletter purposes. One or more data files are created for each application. However, duplicated files results in data redundancy. The problem with data redundancy is the possibility that updates are accomplished in one file but not in another, resulting in a lack of data integrity. Likewise, maintaining separate files is generally inefficient because the work of updating and managing the files is duplicated for each separate file that exists. To overcome potential problems with traditional data management, the database approach was developed.

The database approach is such that multiple business applications access the same database. Consequently, file updates are not required of multiple files. Updates can be accomplished in the common database, thus improving data integrity and eliminating redundancy. The database approach provides the opportunity to share data, as well as information sources. Additional software is required to implement the database approach to data management. A database management system (DBMS) is needed. A DBMS consists of a group of programs that are used in an interface between a database and the user, or between the database and the application program. Advantages of the database approach are presented in Table 1. Disadvantages of the database approach are presented in Table 2.

**DATA ORGANIZATION.** Data organization is critical to optimal data use. Consequently, it is important to organize data in such a manner as to reflect business operations and practices. As such, careful consideration should be given to content, access, logical structure, and physical organization. Content refers to what data are going to be collected. Access refers to the users that data are provided to when appropriate. Logical structure refers to how the data will be arranged. Physical structure refers to where the data will be located.

One tool that database designers use to show the logical relationships among data is a data model, which is a map or diagram of entities and their relationships. Consequently, data modeling requires a thorough understanding of business practices and what kind of data and information is needed.

**DATABASE MODELS.** The structure of the relationships in most databases follows one of three logical database models: hierarchical, network, and relational.

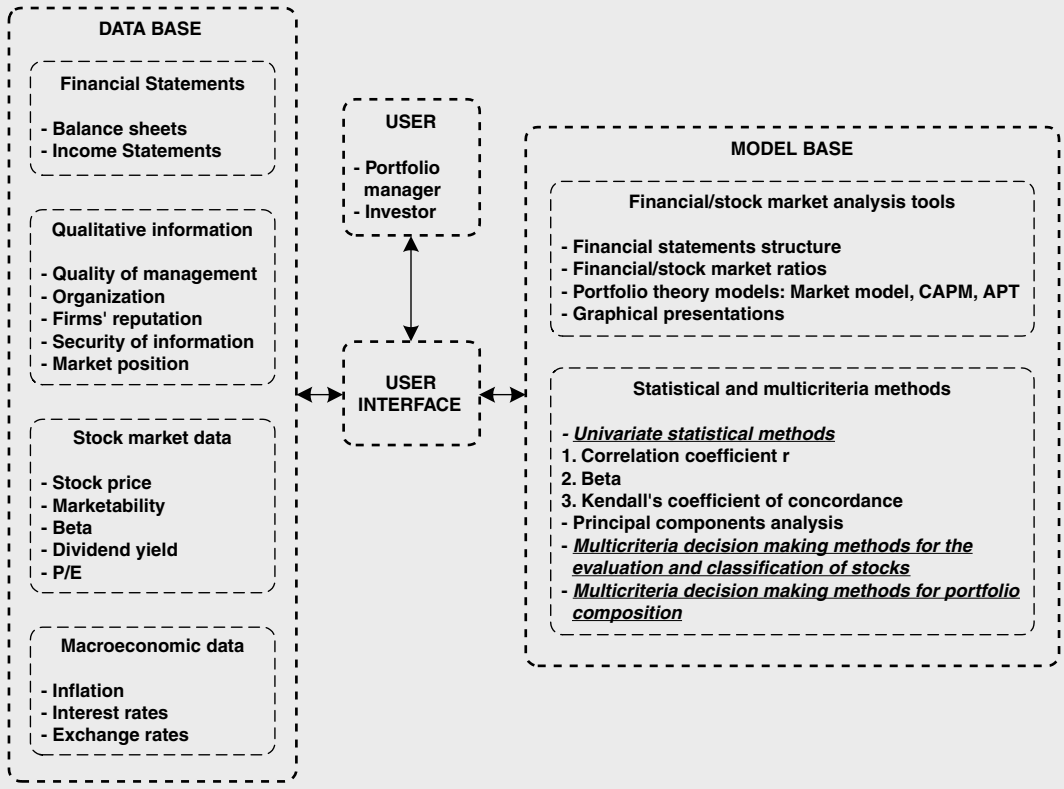
A hierarchical database model is one in which the data are organized in a top-down or inverted tree-like structure. This type of model is best suited for situations where the logical relationships between data can be properly represented with the one-parent-many-children approach.

A network model is an extension of the hierarchical database model. The network model has an owner-member relationship in which a member may have many owners, in contrast to a one-to-many-relationship.

A relational model describes data using a standard tabular format. All data elements are placed in two-dimensional tables called relations, which are the equivalent of files. Data inquiries and manipulations can be made via columns or rows given specific criteria.

Network database models tend to offer more flexibility than hierarchical models. However, they are more difficult to develop and use because of relationship complexity. The relational database model offers the most flexibility, and was very popular during the early 2000s.

**Figure 1**
**Structure of the INVESTOR System**




**DATABASE MANAGEMENT SYSTEMS.** As indicated previously, a database management system (DBMS) is a group of programs used as an interface between a database and an applications program. DBMSs are classified by the type of database model they support. A relational DBMS would follow the relational model, for example. The functions of a DBMS include data storage and retrieval, database modifications, data manipulation, and report generation.

A data definition language (DDL) is a collection of instructions and commands used to define and describe data and data relationships in a particular database. File descriptions, area descriptions, record descriptions, and set descriptions are terms the DDL defines and uses.

A data dictionary also is important to database management. This is a detailed description of the structure and intended content in the database. For example, a data dictionary might specify the maximum number of characters allowed in each type of field and whether the field content can include numbers, letters, or specially formatted content such as dates or currencies. Data dictionaries are used to provide a standard definition of terms and data elements, assist programmers in designing and writing programs, simplify database modifications, reduce data redundancy,

**Table 2**
**Disadvantage of the Database Approach**

| Disadvantages | Explanation |
|---|---|
| Relative high cost of purchasing and operating a DBMS in a mainframe operating environment | Some mainframe DBMSs can cost millions of dollars. |
| Specialized staff | Additional specialized staff and operating personnel may be needed to implement and coordinate the use of the database. It should be noted, however, that some organizations have been able to implement the database approach with no additional personnel. |
| Increased vulnerability | Even though databases offer better security because security measures can be concentrated on one system, they also may make more data accessible to the trespasser if security is breached. In addition, if for some reason there is a failure in the DBMS, multiple application programs are affected. |

increase data reliability, and decrease program development time.

The choice of a particular DBMS typically is a function of several considerations. Economic cost considerations include software acquisition costs, maintenance costs, hardware acquisition costs, database creation and conversion costs, personnel costs, training costs, and operating costs.

Most DBMS vendors are combining their products with text editors and browsers, report generators, listing utilities, communication software, data entry and display features, and graphical design tools. Consequently, those looking for a total design system have many choices.

**DATA WAREHOUSING.** Data warehousing involves taking data from a main computer for analysis without slowing down the main computer. In this manner, data are stored in another database for analyzing trends and new relationships. Consequently, the data warehouse is not the live, active system, but it is updated daily or weekly. For example, Wal-Mart uses a very large database (VLDB) that is 4 trillion bytes (terabytes) in size. Smaller parts of this database could be warehoused for further analysis to avoid slowing down the VLDB.

**FUTURE TRENDS.** A private database is compiled from individual consumer or business customer names and addresses maintained by a company for use in its own marketing efforts. Such a database may have originated as a public database, but typically once the company begins adding or removing information it is considered a private database. By contrast, public databases are those names, addresses, and data that are complied for resale in the list rental market. This is publicly available data (i.e., any business can purchase it on the open market) rather than lists of specific customers or targets.

However, a new trend is combining features of the two approaches. Cooperative databases are compiled by combining privately held response files of participating companies so that costs are shared. Many consider this to be a future trend, such that virtually all catalog marketers, for example, would use cooperative databases.

Geographic Information Systems (GIS) are becoming a growing area of data management. GIS involves the combining demographic, environmental, or other business data with geographic data. This can involve road networks and urban mapping, as well as consumer buying habits and how they relate to the local geography. Output is often presented in a visual data map that facilitates the discovery of new patterns and knowledge.

Customer Resource Management (CRM) is another area where data process and data management is deeply involved. CRM is a set of methodologies and software applications for managing the customer relationship. CRM provides the opportunity for management, salespeople, marketers, and potentially even customers, to see sufficient detail regarding customer activities and contacts. This allows companies to provide other possible products or useful services, as well as other business options. Security of this information is of significant concern on both sides of the equation.

*SEE ALSO:* Computer Networks; Computer Security

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## DEBT VS. EQUITY FINANCING

Debt vs. equity financing is one of the most important decisions facing managers who need capital to fund their business operations. Debt and equity are the two main sources of capital available to businesses, and each offers both advantages and disadvantages. "Absolutely nothing is more important to a new business than raising capital," Steve Jefferson wrote in *Pacific Business News* (Jefferson, 2001). "But the way that money is raised can have an enormous impact on the success of a business."

### DEBT FINANCING

Debt financing takes the form of loans that must be repaid over time, usually with interest. Businesses can borrow money over the short term (less than one year) or long term (more than one year). The main sources of debt financing are banks and government agencies, such as the Small Business Administration (SBA). Debt financing offers businesses a tax advantage, because the interest paid on loans is generally deductible. Borrowing also limits the business's future obligation of repayment of the loan, because the lender does not receive an ownership share in the business.

However, debt financing also has its disadvantages. New businesses sometimes find it difficult to make regular loan payments when they have irregular cash flow. In this way, debt financing can leave businesses vulnerable to economic downturns or interest rate hikes. Carrying too much debt is a problem because it increases the perceived risk associated with businesses, making them unattractive to investors and thus reducing their ability to raise additional capital in the future.

### EQUITY FINANCING

Equity financing takes the form of money obtained from investors in exchange for an ownership share in the business. Such funds may come from friends and family members of the business owner, wealthy "angel" investors, or venture capital firms. The main advantage to equity financing is that the business is not obligated to repay the money. Instead, the investors hope to reclaim their investment out of future profits. The involvement of high-profile investors may also help increase the credibility of a new business.

The main disadvantage to equity financing is that the investors become part-owners of the business, and thus gain a say in business decisions. "Equity investors are looking for a partner as well as an investment, or else they would be lenders," venture capitalist Bill Richardson explained in *Pacific Business News* (Jefferson, 2001). As ownership interests become diluted, managers face a possible loss of autonomy or control. In addition, an excessive reliance on equity financing may indicate that a business is not using its capital in the most productive manner.

Both debt and equity financing are important ways for businesses to obtain capital to fund their operations. Deciding which to use or emphasize, depends on the long-term goals of the business and the amount of control managers wish to maintain. Ideally, experts suggest that businesses use both debt and equity financing in a commercially acceptable ratio. This ratio, known as the debt-to-equity ratio, is a key factor analysts use to determine whether managers are running a business in a sensible manner. Although debt-to-equity ratios vary greatly by industry and company, a general rule of thumb holds that a reasonable ratio should fall between 1:1 and 1:2.

Some experts recommend that companies rely more heavily on equity financing during the early stages of their existence, because such businesses may find it difficult to service debt until they achieve reliable cash flow. But start-up companies may have trouble attracting venture capital until they demonstrate strong profit potential. In any case, all businesses require sufficient capital in order to succeed. The most prudent course of action is to obtain capital from a variety of sources, using both debt and equity, and hire professional accountants and attorneys to assist with financial decisions.

*SEE ALSO:* Due Diligence; Financial Issues for Managers; Financial Ratios

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## DECISION MAKING

The essence of management is making decisions. Managers are constantly required to evaluate alternatives and make decisions regarding a wide range of matters. Just as there are different managerial styles, there are different decision-making styles. Decision making involves uncertainty and risk, and decision makers have varying degrees of risk aversion. Decision making also involves qualitative and quantitative analyses, and some decision makers prefer one form of analysis over the other. Decision making can be affected not only by rational judgment, but also by nonrational factors such as the personality of the decision maker, peer pressure, the organizational situation, and others.

Management guru Peter F. Drucker, as quoted in *Association Management,* identified eight "critically important" decision-making practices that successful executives follow. Each:

1. Ask "What needs to be done?"
2. Ask "What is right for the enterprise?"
3. Develop action plans
4. Take responsibility for decisions
5. Take responsibility for communicating
6. Focus on opportunities rather than problems
7. Run productive meetings
8. Think and say "we" rather than "I"

### POSING THE PROBLEM CORRECTLY

According to Ralph L. Keeney, professor at the University of Southern California's Marshall School of Business and co-author of *Smart Choices: A Practical Guide to Making Better Decisions,* managers commonly consider too few alternatives when making difficult decisions. When approaching a problem, decision makers need to regularly consider, starting at the outset, "Is this what I really need to decide?" In addition, the nature of the problem may change during the decision-making process, as either the situation changes or the decision maker's insights into the situation change.

By not formulating the problem correctly, decision makers risk missing a whole range of other alternatives. Decision makers can improve the chances of asking the right question by probing objectives, goals, interests, fears, and aspirations. They also need to consider very carefully the consequences of each alternative. They can devise new alternatives through brainstorming and imagining as many options as possible, keeping in mind objectives, but not necessarily being entirely practical at first. In practice, action-oriented decision makers tend to focus on solutions without considering whether they are working on the right problem. Instead of choosing from decisions selected by others, decision makers need to review what decisions they should be addressing.

Managers in a corporate setting tend to view decision making differently than entrepreneurs. Since they are typically given a fixed amount of budgeted resources to work with, managers tend to define a problem in terms of what can be done with the resources at hand. Entrepreneurs, on the other hand, will likely pose the problem in terms of an objective—"This is what I want to get done"—and then worry about finding the resources to accomplish that objective. As a result, entrepreneurial decision makers will lay out a wider range of alternatives from which to choose. They feel less constrained by a lack of resources. To develop more alternatives, decision makers should release themselves from existing constraints, think imaginatively, and brainstorm with others, all the while keeping objectives clearly in mind and being honest about what they really need or desire.

### SYSTEMATIC ANALYSIS VS. INTUITIVE ANALYSIS

Entrepreneurs are famous for making "seat-of-the-pants" decisions, which means they make quick decisions based on a gut feeling or intuition. They are often forced to make decisions under conditions of uncertainty and without all of the necessary information. While some entrepreneurs are good decision makers, others need to be more cautious about the intuitive approach. One case against intuitive decision making comes from the credit industry. For example, some banks use scoring models for consumer and small business loans, but at times individual bankers override the automated system because they intuitively disagreed with the computer model's results. These loans, however, invariably have higher delinquency and charge off rates than loans approved by the computer model.

In some cases a person's intuition will be in conflict with the results of a more formal or systematic analysis, resulting in an uncomfortable feeling for the decision maker. What should a decision maker do then? Howard Raiffa, Harvard Business School professor emeritus, recommended in *Inc.:* "You should review both sides of the ledger to see if your intuition holds up when it is informed with some systematic

analysis. And if your analysis seems wrong intuitively, don't accept the analysis, just keep on probing." The uncomfortable feeling may be sending a message to the decision maker that it's not quite time to act, that perhaps a little more thinking about the problem is required.

Emotions are one of several nonrational factors that play a role in decision making. According to Raiffa, decision makers should pay attention to emotions and feelings when making decisions. By partially committing to one alternative, decision makers can give themselves a chance to "sleep on it," which then becomes a way of testing different alternatives. In spite of practical recommendations to not let emotions play a part in decision making, emotions do come into play because the decision maker cares about the consequences that may occur as a result of any decision made.

Making quick decisions, something managers are often required to do, does not necessarily mean sacrificing systematic decision making. Managers can prepare themselves for making quick decisions by practicing pre-decision making. This involves keeping in mind a decision-making structure, such as a series of probing questions that must be answered, as a contingency plan in the event a quick decision is needed.

## UNCERTAINTY AND RISK

Many decisions must be made in the absence of complete information. Decision makers often have to act without knowing for certain all of the consequences of their decisions. Uncertainty simply increases the number of possible outcomes, and the consequences of these outcomes should be considered. That is, it is important for the decision maker to identify what the uncertainties are, what the possible outcomes are, and what the consequences would be. Decision makers can sometimes clarify the problem they are working on by listing what could happen and assigning probabilities to each possible outcome (a formal representation of this is known as a *decision tree*).

Risk aversion is another nonrational factor affecting sound decision making. Studies have shown that people who exhibit risk-averse behavior in one setting will become risk-seekers when offered the same choice in a different setting. For example, most people will display risk-averse behavior by rejecting a fair gamble in favor of a certain gain. However, when the choice involves a fair gamble and a certain loss, most people display risk-seeking behavior by choosing the gamble over the certain loss, even though the risky choice may well result in an even greater loss.

The valuation of a risky alternative appears to depend more on the reference point from which a possible gain or loss will occur, than on the absolute gain to be realized. That is, the decision maker is motivated not by the absolute performance of a particular alternative, but whether that alternative will perform better or worse relative to a specific reference point. Consequently, decision makers can be easily influenced by shifting reference points.

## DECISIONS BASED ON PRINCIPLES

Principled decision making can be a useful complement or alternative to analytical decision making. Principled decision making may or may not involve ethics. Ethical decision making uses ethical (moral) principles to make decisions, while principled decision making can employ all kinds of principles (i.e., including potentially unethical principles or decisions that lead to unethical outcomes). While not widely used, principled decision making is sometimes used by investment managers to manage risk and uncertain investments. Risk and portfolio managers may turn to principled decision making for complex risk management problems that cannot be modeled or solved.

Principled decision making emphasizes the process of decision making, with the end results of the decision being of secondary concern. It is essentially a two-step process, with the first step being to select and communicate the right principles to which decisions must adhere. The second step requires the decision maker to apply the appropriate principles. Principled decision making is easy to understand, and the principled decisions are easy to communicate to others in an organization.

Principles can be used to assist analytical decision making. For example, a portfolio manager may use principles as screens to segregate potential investments into acceptable and unacceptable categories. This effectively defines the search dimensions and reduces the sample space. Once principles have been used to reduce a problem to manageable size, then analytical techniques can be employed to make a final selection.

Principled decision making can be applied as an alternative to analytical decision making in such areas as organizational missions, goals, strategies, and codes of conduct. Sears, Roebuck and Co. was founded on the principle that the customer is always right, and that principle has served to guide corporate decisions over the years. Such principles, when used in decision making, can help the organization better cope with changes over time, shifts in leaders, fluctuating leadership styles, and changing market conditions.

## THE ROLE OF INFORMATION: DECISION SUPPORT SYSTEMS

Armed with information, managers can make better decisions. Frontline managers, for example, who are supplied with direct activity cost information,

can better manage revenues, margins, and costs. Organizations can achieve more consistency between upper management and lower-level managers by providing more information throughout the organization.

With Internet-hosted databases and user-friendly query tools becoming more common, corporations are turning to decision support systems (DSS) software to analyze the firm's databases and turn them into information useful for decision makers. DSS typically includes analytical and report-writing features, thus enabling users to translate raw data into a form useful for decision support.

Decision support technology is a relatively new development in software and may not yet be a high priority with the firm's information technology (IT) department. DSS, which offers users more flexible programming paradigms, can be compared to another type of software, enterprise resource planning (ERP), which enhances productivity by accelerating routine operations. DSS, on the other hand, slices and dices data that may be novel and complex into understandable chunks to facilitate shared consideration of multiple criteria.

One DSS technique is called analytic hierarchy process (AHP), which enables users to attack complex problems by reducing them to simpler pairwise comparisons between different combinations of options and criteria. When people are able to choose between pairs of options, their decisions are made more quickly and consistently than when larger sets of options must be considered. AHP was invented by Thomas Saaty, who cofounded Expert Choice Inc. (http://www.expertchoice.com) to provide AHP-related software and services.

DSS can result in significant time savings as well as improved decision making. Home products retailer Payless Cashways reported that its DSS software enabled it to realize a 70 percent time reduction in information and report gathering and a 30 percent rise in user productivity, along with reduced training time and better decisions on marketing, staffing, and warehousing. The company used DSS to extract and sort information related to sales volume, category performance, comparable-store sales, and in-stock figures.

DSS can speed collaboration when there are several decision makers who must be satisfied. By providing multiple users with access to the firm's data, DSS can clarify the decision-making process and enhance consistency among multiple decision makers. With electronic commerce competitors responding to strategic decisions within days or even hours, the speed with which decisions are made becomes more critical. DSS helps decision makers consider a wider range of alternatives in a shorter period of time. When more consideration is given to the probability and value of the competition's response, strategic decision making becomes more like game theory.

## STRATEGIC DECISION MAKING

Strategic decisions are those that affect the direction of the firm. These major decisions concern areas such as new products and markets, acquisitions and mergers, subsidiaries and affiliates, joint ventures and strategic alliances, and other matters. Strategic decision making is usually conducted by the firm's top management, led by the CEO or president of the company.

In markets characterized by extreme competition and a rapid pace of change, companies are being forced to compete on the edge. Their strategic thinking can no longer be limited to identifying promising industries, core competencies, and strategic positions. Rather, top management is engaged in creating a continuing flow of temporary and shifting competitive advantages relative to other competitors and the market being served. As a result, greater emphasis is placed on efficient strategic decision making to create effective strategies.

Kathleen M. Eisenhardt, professor of strategy and organization at Stanford University, studied the strategic decision-making processes at different companies in high-velocity markets. Strategic decision makers at more effective firms were able to make quick, high-quality decisions that were widely supported throughout the firm. Her studies identified four areas in which effective strategic decision makers outperformed counterparts at less effective firms: (1) building collective intuition, (2) stimulating conflict, (3) maintaining a pace or schedule for decision making, and (4) defusing political behavior.

## PREDICTIVE MARKETS

Also termed "betting markets" or "idea markets," prediction markets emerged during 2004 as a way to assess consensus opinion about questions of importance to corporate decision makers. As discussed by James M. Pethokoukis in *U.S. News & World Report,* companies such as Hewlett-Packard and Dentsu were exploring use of prediction markets to forecast corporate figures such as revenues, advertising demand, consumer trends, and employee retention. These markets enable companies to determine what products or decisions are more likely to be successful and where to focus resources. Firms were still researching how well this works and where it could best be applied. A senior manager at Dentsu explained, "The key value we see is that prediction markets have the potential to extract the best essence from group knowledge, as an alternative to majority decisions."

## BUILDING COLLECTIVE INTUITION

Effective decision makers built a collective intuition by sharing information at "must-attend" meetings. They reviewed internal and external information, preferring real-time operational information over accounting-based data. At one firm each top manager was responsible for gathering and reporting data from a particular area. The managers gained an enhanced understanding of the data by discussing it from different perspectives at these meetings. The meetings also gave them a chance to get to know one another better, leading to open and direct interactions.

## STIMULATING CONFLICT

Many decision makers tend to avoid conflict, fearing it will bog down the decision-making process and degenerate into personal attacks. However, Eisenhardt's studies found that in dynamic markets, conflict is a natural feature where reasonable managers will often diverge in assessments of how a market will develop. She found that conflict stimulates innovative thinking, creates a fuller understanding of options, and improves decision effectiveness. Without conflict, decision makers often overlooked key elements of a decision and missed opportunities to question assumptions.

Executives accelerated conflict by forming diverse executive teams made up of individuals who differed in age, gender, functional background, and corporate experience. Other techniques that can introduce conflict quicker include scenario planning, where teams systematically consider strategic decisions in light of several possible futures, and role playing, where executives advocate alternatives that they may or may not favor and play the role of competitors. Debate is encouraged and conflict stimulated when as broad a range of alternatives as possible is presented for discussion.

## MAINTAINING A SCHEDULE

Strategic decision makers are faced with a dilemma when they feel that every strategic decision they make is unique, yet they feel pressured to make decisions as quickly as possible. Effective decision makers overcome this dilemma by focusing on the pace of decision making, not the speed with which a decision is made. By using general rules of thumb regarding how long a particular type of decision should take, they maintain decision-making momentum by launching the decision-making process promptly, keeping up the energy surrounding the process, and cutting off debate at the appropriate time.

In order to keep to a specific time frame, executives can alter or adjust the scope of a particular decision to fit the allotted timeframe by viewing it as part of a larger web of strategic choices. Eisenhardt's studies found that effective decision makers followed the natural rhythm of strategic choice. The rule for how long major decisions should take was a fairly constant two to four months. Decisions that would take less time were considered not important enough for the executive team, while those that appeared to take longer involved either too big an issue or management procrastination. By recognizing similarities among strategic decisions, such as those involving new products, new technologies, or acquisitions, executives could more easily gauge the scale of a decision.

One of the most effective methods for cutting off debate was a two-step method called "consensus with qualification." The decision-making process is conducted with consensus as a goal. If consensus is achieved, then the decision is made. However, if there is no consensus, then the deadlock can be broken by using a decision rule such as voting or, more commonly, letting the executive with the largest stake in the outcome make the final decision. By taking a realistic view of conflict as both valuable and inevitable, consensus with qualification helps maintain the pace of decision making. It helps managers plan progress and emphasizes that keeping to schedule is more important than forging consensus or developing massive data analyses.

## DEFUSING POLITICS

The high stakes of strategic decision making can quickly turn the decision-making process into one of competition among ambitious managers. While less effective strategic decision makers view politics as a natural part of the decision-making process, effective strategic decision makers take a negative view of politicking. They not only see it as wasting valuable time, it can distort the information base, since politicking managers will tend to use information to their own advantage.

Politicking can be defused by emphasizing a collaborative, rather than competitive, environment, and by creating common goals. Rather than implying homogeneous thinking, common goals suggest that managers have a shared vision of where they want to be or who external competitors are. A balanced power structure, in which each key decision maker has a clear area of responsibility and the leader is recognized as the most powerful decision maker, can also defuse politicking among executives. The clear delineation of responsibility facilitates information sharing and other interaction, because each executive is operating from a secure power base. Finally, humor can defuse politicking and help build a collaborative outlook.

## AN EIGHT-STEP APPROACH TO MAKING BETTER DECISIONS

The following list is adapted from Smart Choices by Hammond, et al.:

1. Work on the right decision problem. Be careful in stating the problem, and avoid unwarranted assumptions and option-limiting prejudices.
2. Specify your objectives. Determine what you want to accomplish, and which of your interests, values, concerns, fears, and aspirations are the most relevant.
3. Create imaginative alternatives. Alternatives represent different courses of action, and your decision can be no better than your best alternative.
4. Understand the consequences. Determine how well different alternatives satisfy all of your objectives.
5. Grapple with your tradeoffs. Since objectives frequently conflict with each other, it becomes necessary to choose among less-than-perfect possibilities.
6. Clarify your uncertainties. Confront uncertainty by judging the likelihood of different outcomes and assessing their possible impacts.
7. Think hard about your risk tolerance. In order to choose an alternative with an acceptable level of risk, become conscious of how much risk you can tolerate.
8. Consider linked decisions. Many important decisions are linked over time. The key to making a series of decisions is to isolate and resolve near-term issues while gathering information relevant to issues that will arise later.

*SEE ALSO:* Decision Rules and Decision Analysis; Decision Support Systems

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*Revised by Wendy H. Mason*

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## DECISION RULES AND DECISION ANALYSIS

A decision rule is a logical statement of the type "if [condition], then [decision]." The following is an example of a decision rule experts might use to determine an investment quality rating:

> If the year's margin is at least 4.27 percent and the year's ratio of shareholder funds to fixed assets is at least 35.2 percent, then the class of rating is at least lower investment grade (LIG).

The condition in this decision rule is "the year's margin is at least 4.27 percent and the year's ratio of shareholder funds to fixed assets is at least 35.2 percent," while "the class of rating is at least lower investment grade" is the decision part of the rule.

Decision rules give a synthetic, easily understandable, and generalized representation of the knowledge contained in a data set organized in an information table. The table's rows are labeled by objects, whereas columns are labeled by attributes; entries in the body of the table are thus attribute values. If the objects are exemplary decisions given by a decision maker, then the decision rules represent the preferential attitude of the decision maker and enable understanding of the reasons for his or her preference.

People make decisions by searching for rules that provide good justification of their own choices. However, a direct statement of decision rules requires a great cognitive effort from the decision maker, who typically is more confident making exemplary decisions than explaining them. For this reason, the idea of inferring preference models in terms of decision rules from exemplary decisions provided by the decision maker is very attractive. The induction of rules from examples is a typical approach of artificial intelligence. It is concordant with the principle of posterior

rationality, and with aggregation-disaggregation logic. The recognition of the rules by the decision maker justifies their use as a powerful decision support tool for decision making concerning new objects.

There are many applications of decision rules in business and finance, including:

- Credit card companies use decision rules to approve credit card applications.
- Retailers use associative rules to understand customers' habits and preferences (market basket analysis) and apply the finding to launch effective promotions and advertising.
- Banks use decision rules induced from data about bankrupt and non-bankrupt firms to support credit granting decisions.
- Telemarketing and direct marketing companies use decision rules to reduce the number of calls made and increase the ratio of successful calls.

Other applications of decision rules exist in the airline, manufacturing, telecommunications, and insurance industries.

## DESCRIBING AND COMPARING INFORMATION ATTRIBUTES

The examples (information) from which decision rules are induced are expressed in terms of some characteristic attributes. For instance, companies could be described by the following attributes: sector of activity, localization, number of employees, total assets, profit, and risk rating. From the viewpoint of conceptual content, attributes can be of one of the following types:

- Qualitative attributes (symbolic, categorical, or nominal), including sector of activity or localization
- Quantitative attributes, including number of employees or total assets
- Criteria or attributes whose domains are preferentially ordered, including profit, because a company having large profit is preferred to a company having small profit or even loss

The objects are compared differently depending on the nature of the attributes considered. More precisely, with respect to qualitative attributes, the objects are compared on the basis of an indiscernibility relation: two objects are indiscernible if they have the same evaluation with respect to the considered attributes. The indiscernibility relation is reflexive (i.e., each object is indiscernible with itself), symmetric (if object A is indiscernible with object B, then object B also is indiscernible with object A), and transitive (if object A is indiscernible with object B and object B is indiscernible with object C, then object A also is indiscernible with object C). Therefore, the indiscernibility relation is an equivalence relation.

With respect to quantitative attributes, the objects are compared on the basis of a similarity relation. The similarity between objects can be defined in many different ways. For example, if the evaluations with respect to the considered attribute are positive, then the following statement may define similarity:

$$\frac{\text{Evaluation of A} - \text{Evaluation of B}}{\text{Evaluation of B}} \leq \text{Threshold}$$

For instance, with respect to the attribute "number of employees," fixing a threshold at 10 percent, Company A having 2,710 employees is similar to Company B having 3,000 employees. Similarity relation is reflexive, but neither symmetric nor transitive; the abandon of the transitivity requirement is easily justifiable, remembering, for example, Luce's paradox of the cups of tea (Luce, 1956). As for the symmetry, one should notice that the proposition *y*R*x,* which means "*y* is similar to *x,*" is directional; there is a subject *y* and a referent *x,* and in general this is not equivalent to the proposition "*x* is similar to *y.*"

With respect to criteria, the objects are compared on the basis of a dominance relation built using outranking relations on each considered criterion: object A outranks object B with respect to a given criterion if object A is at least as good as object B with respect to this criterion; if object A outranks object B with respect to all considered criteria then object A dominates object B. An outranking relation can be defined in many different ways. Oftentimes, it is supposed that outranking is a complete preorder (i.e., transitive and strongly complete). For each couple of objects, say object A and object B, at least one of the following two conditions is always verified: object A outranks object B and/or object B outranks object A. A dominance relation, built on the basis of the outranking relation being a complete preorder, is a partial preorder (i.e., it is reflexive and transitive, but in general not complete).

## DECISION RULE SYNTAX

The syntax of decision rules is different according to the specific decision problem. The following decision problems are most frequently considered:

- Classification
- Sorting
- Choice
- Ranking

Following is a presentation of the syntax of decision rules considered within each one of the above decision problems.

**CLASSIFICATION.** Classification concerns an assignment of a set of objects to a set of predefined but nonordered classes. A typical example of classification is the problem of market segmentation; in general there is no preference order between the different segments. The objects are described by a set of (regular) attributes that can be qualitative or quantitative. The syntax of decision rules specifies the condition part and the decision part.

With respect to the condition part, the following types of decision rules can be distinguished:

1. Decision rules based on qualitative attributes: "if the value of attribute $q_1$ is equal to $r_{q1}$ and the value of attribute $q_2$ is equal to $r_{q2}$ and . . . and the value of attribute $q_p$ is equal to $r_{qp}$, then [decision]," where $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered attributes.
2. Decision rules based on quantitative attributes: "if the value of attribute $q_1$ is similar to $r_{q1}$ and the value of attribute $q_2$ is similar to $r_{q2}$ and . . . and the value of attribute $q_p$ is similar to $r_{qp}$, then [decision]," where $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered attributes.
3. Decision rules based on qualitative and quantitative attributes: "if the value of attribute $q_1$ is equal to $r_{q1}$ and the value of attribute $q_2$ is equal to $r_{q2}$ and . . . and the value of attribute $q_t$ is equal to $r_{qt}$ and the value of attribute $q_{t+1}$ is similar to $r_{qt+1}$ and the value of attribute $q_{t+2}$ is similar to $r_{qt+2}$ and . . . and the value of attribute $q_p$ is similar to $r_{qp}$, then [decision]," where $q_1$ $q_2$ . . . , $q_t$ are qualitative attributes, $q_{t+1}$, $q_{t+2}$, . . . , $q_p$ are quantitative attributes, and $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered attributes.

With respect to the decision part, the following types of decision rules can be distinguished:

1. Exact decision rule: "if [condition], then the object belongs to $Y_j$," where $Y_j$ is a decision class of the considered classification.
2. Approximate decision rule: "if [condition], then the object belongs to $Y_{j1}$ or $Y_{j2}$ or . . . $Y_{jk}$," where $Y_{j1}$, $Y_{j2}$, . . ., $Y_{jk}$ are some decision classes of the considered classification.
3. Possible decision rule: "if [condition], then the object could belong to $Y_j$," where $Y_j$ is a decision class of the considered classification.

**SORTING.** Sorting concerns an assignment of a set of objects to a set of predefined and preference ordered classes. The classes are denoted by $Cl_1$ $Cl_2$ and so on, and we suppose that they are preferentially ordered such that the higher the number the better the class (i.e., the elements of class $Cl_2$ have a better comprehensive evaluation than the elements of class $Cl_1$ the elements of class $Cl_3$ have a better comprehensive evaluation than the elements of class $Cl_2$ and so on. For example, in a problem of bankruptcy risk evaluation, $Cl_1$ is the set of unacceptable-risk firms, $Cl_2$ is a set of high-risk firms, $Cl_3$ is a set of medium-risk firms, and so on. The objects are evaluated by a set of attributes that generally include criteria and qualitative and/or quantitative (regular) attributes. The syntax of the condition depends on the type of attributes used for object description. If there are criteria only, then the following types of decision rules can be distinguished:

1. Exact D≥ decision rule: "if evaluation with respect to criterion $q_1$ is at least as good as $r_{q1}$ and evaluation with respect to criterion $q_2$ is at least as good as $r_{q2}$ and . . . evaluation with respect to criterion $q_p$ is at least as good as $r_{qp}$, then the object belongs to at least class $t$," where $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered criteria.
2. Exact D≤ decision rule: "if evaluation with respect to criterion $q_1$ is at most as good as $r_{q1}$ and evaluation with respect to criterion $q_2$ is at most as good as $r_{q2}$ and . . . evaluation with respect to criterion $q_p$ is at most as good as $r_{qp}$, then the object belongs to at most class $t$," where $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered criteria.
3. Approximate D≥≤ decision rule: "if evaluation with respect to criterion $q_1$ is at least as good as $r_{q1}$ and evaluation with respect to criterion $q_2$ is at least as good as $r_{q2}$ and . . . evaluation with respect to criterion $q_h$ is at least as good as $r_{qh}$ and evaluation with respect to criterion $q_{h+1}$ is at most as good as $r_{qh+1}$ and evaluation with respect to criterion $q_{h+2}$ is at most as good as $r_{qh+2}$ and . . . evaluation with respect to criterion $q_p$ is at most as good as $r_{qp}$, then the object belongs to at least class $t$ and at most to class $t'$" where criteria $q_1$ $q_2$ . . ., $q_k$ are not necessarily different from $q_{k+1}$, $q_{k+2}$, . . ., $q_p$ and $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered criteria.
4. Possible D≥ decision rule: "if evaluation with respect to criterion $q_1$ is at least as good as $r_{q1}$ and evaluation with respect to criterion $q_2$ is at least as good as $r_{q2}$ and . . . evaluation with respect to criterion $q_p$ is at least as good as $r_{qp,}$ then the object could belong to at least class $t$," where $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered criteria.

5. Possible D≤ decision rule: "if evaluation with respect to criterion $q_1$ is at most as good as $r_{q1}$ and evaluation with respect to criterion $q_2$ is at most as good as $r_{q2}$ and . . . evaluation with respect to criterion $q_p$ is at most as good as $r_{qp}$, then the object could belong to at most class *t,*" where $r_{q1}$, $r_{q2}$, . . ., $r_{qp}$ are possible values of considered criteria.

**CHOICE AND RANKING.** Choice concerns selecting a small subset of best objects from a larger set, while ranking concerns ordering objects of a set from the best to the worst. In these two decision problems, the objects are evaluated by criteria and the decision is based on pairwise (relative) comparison of objects rather than on absolute evaluation of single objects. In other words, in these two cases the decision rules relate preferences on particular criteria with a comprehensive preference. The preferences can be expressed on cardinal scales or on ordinal scales: the former deal with strength of preferences and use relations like indifference, weak preference, preference, strong preference, absolute preference, while for the later the strength is meaningless.

Given objects *x, y, w* and *z,* and using a cardinal scale of preference, it always is possible to compare the strength of preference of *x* over *y* with the strength of preference of *w* over *z* and say whether the preference of *x* over *y* is stronger than, equal to, or weaker than the preference of *w* over *z.* Using an ordinal scale, the strengths of preference can be compared only if, with respect to the considered criterion, object *x* is at least as good as *w* and *z* is at least as good as *y.* Given an example of car selection, for any decision maker car *x,* with a maximum speed 200 kilometers per hour (124.28 miles per hour) is preferred to car *y,* with a maximum speed of 120 kilometers per hour (74.57 miles per hour) at least as much as car *w,* with a maximum speed 170 kilometers per hour (105.64 miles per hour) is preferred to car *z,* with a maximum speed 140 kilometers per hour (87 miles per hour). This is because it is always preferable to pass from a smaller maximum speed (car *y* versus *z*) to a larger maximum speed (car *x* versus *w*). The syntax of the decision rules in the choice and ranking problems depends on the distinction between cardinal and ordinal criteria:

1. Exact D≥ decision rule: "if with respect to cardinal criterion $q$ 1, *x* is preferred to *y* with at least strength $h(q\ 1)$ and . . . and with respect to cardinal criterion *qe, x* is preferred to *y* with at least strength $h(qe)$ and with respect to ordinal criterion $qe + 1$, evaluation of *x* is at least as good as $r_{qe+1}$ and evaluation of *y* is at most as good as $s_{qe+1}$ and . . . and with respect to ordinal criterion $q_{p+1}$, evaluation of *x* is at least as good as $r_{qp+1}$ and evaluation of *y* is at most as good as $s_{qp+1}$, then *x* is at least as good as *y,*" where $h(q\ 1)$, . . ., $h(qe)$ are possible strengths of preferences of considered criteria and $r_{qe+1}$, . . ., $r_{qp}$, and $s_{qe+1}$, . . . , $s_{qp}$ are possible values of considered criteria. A more concise illustration: "if with respect to comfort (cardinal criterion) car *x* is at least strongly preferred to car *y* and car *x* has a maximum speed (ordinal criterion) of at least 200 kilometers per hour (124.28 miles per hour) and car *y* has a maximum speed of 160 kilometers per hour (99.42 miles per hour), then car *x* is at least as good as car *y.*"

2. Exact D≤ decision rule: "if with respect to cardinal criterion $q$ 1, *x* is preferred to *y* with at most strength $h(q\ 1)$ and . . . and with respect to cardinal criterion *qe, x* is preferred to *y* with at most strength $h(qe)$ and with respect to ordinal criterion $qe + 1$, evaluation of *x* is at most as good as $r_{qe+1}$ and evaluation of *y* is at least as good as $s_{qe+1}$ and . . . and with respect to ordinal criterion *qp,* evaluation of *x* is at most as good as $r_{qp}$ and evaluation of *y* is at least as good as $s_{qp+1}$, then *x* is not at least as good as *y,*" where $h(q\ 1)$, . . ., $h(qe)$ are possible strengths of preferences of considered criteria and $r_{qe+1,}$ . . ., $r_{qp}$, and $s_{qe+1}$, . . ., $s_{qp}$ are possible values of considered criteria. An example of a D≤ decision rule: "if with respect to aesthetics (cardinal criterion) car *x* is at most indifferent with car *y* and car *x* consumes (ordinal criterion) at most 7.2 liters (1.90 gallons) of fuel per 100 kilometers (62.14 miles) and car *y* consumes at least at 7.5 liters (1.98 gallons) of fuel per 100 kilometers (62.14 miles), then car *x* is at most as good as car *y.*"

3. Approximate D≥≤ decision rule: the "if" condition has the syntax composed of the "if" parts of the D≥ rule and the D≤ rule. The "then" decision represents a hesitation: "*x* is at least as good as *y*" or "*x* is not at least as good as *y.*"

Using decision rules, it always is possible to represent all common decision policies. For instance, let us consider the lexicographic ordering: the criteria considered are ranked from the most important to the least important. Between two objects, the object preferred with respect to the most important criterion is preferred to the other; if there is an *ex aequo* (a tie) on the most important criterion, then the object preferred with respect to the second criterion is selected; if there is again an *ex aequo,* then the third most important criterion is considered, and so on. If there is an *ex aequo* on all the considered criteria, then the two objects are indifferent. The lexicographic ordering can be represented by means of the following D≤ decision rules:

1. If *x* is (at least) preferred to *y* with respect to criterion $q$ 1, then *x* is preferred to *y.*

2. If $x$ is (at least) indifferent with $y$ with respect to criterion $q$ 1 and $x$ is (at least) preferred to $y$ with respect to criterion $q$ 2, then $x$ is preferred to $y$.
3. If $x$ is (at least) indifferent with $y$ with respect to all the considered criteria except the last one and $x$ is (at least) preferred to $y$ with respect to criterion $qn$, then $x$ is preferred to $y$.
4. If $x$ is (at least) indifferent with $y$ with respect to all the considered criteria, then $x$ is indifferent to $y$.

Induction of decision rules from information tables is a complex task and a number of procedures have been proposed in the context of such areas like machine learning, data mining, knowledge discovery, and rough sets theory. The existing induction algorithms use one of the following strategies: (a) generation of a minimal set of rules covering all objects from a information table; (b) generation of an exhaustive set of rules consisting of all possible rules for a information table; (c) generation of a set of "strong" decision rules, even partly discriminant, covering relatively many objects each but not necessarily all objects from the information table.

## CREDIBILITY OF DECISION RULES

Decision rules also can be considered from the viewpoint of their credibility. From this point of view, the following classes of decision rules can be distinguished:

1. Crisp, exact decision rules (i.e., the rules presented above whose "then" part is univocal).
2. Crisp, approximate decision rules, induced from an inconsistent part of a data set identified using the rough sets theory; the "then" part of approximate decision rules specifies several possible decisions that cannot be reduced to a single one due to inconsistent information.
3. Possible decision rules covering objects that may belong to the class suggested in the "then" part; the objects that may belong to a class are identified using the rough sets theory as objects belonging to so-called upper approximation of the class.
4. Fuzzy decision rules induced from a vague or imprecise data set using the fuzzy sets theory. Informally, a fuzzy set may be regarded as a class of objects for which there is a graduality of progression from membership to nonmembership: an object may have a grade of membership intermediate between one (full membership) and zero (nonmembership).
5. Probabilistic decision rules covering objects from the class suggested in the "then" part (positive objects), but also objects from other classes (negative objects); the ratio between the positive objects and the negative objects should be at least equal to a given threshold.

## APPLICATIONS

Decision rules have been used for description of many specific decision policies, in particular for description of customers' decisions. The most well known decision rules of this type are the association rules, whose syntax is the following: for $p$ percent of times if items $x_1\ x_2\ \ldots,\ x_n$ were bought, then items $y_1\ y_2\ \ldots,\ y_m$ were bought as well, and $q$ percent of times $x_1\ x_2\ \ldots,\ x_n,\ y_1\ y_2\ \ldots,\ y_m$ were bought together. For example, 50 percent of people who bought diapers also bought beer; diapers and beer were bought in 2 percent of all transactions.

The following example illustrates the most important concepts introduced above. In Table 1, six companies are described by means of four attributes:

**Table 1**
**Sample Information Table**

| Warehouse | Attributes | | | |
|---|---|---|---|---|
| | $A_1$ | $A_2$ | $A_3$ | $A_4$ |
| C1 | high | 700 | A | profit |
| C2 | high | 420 | A | loss |
| C3 | medium | 530 | B | profit |
| C4 | medium | 500 | B | loss |
| C5 | low | 400 | A | loss |
| C6 | low | 100 | B | loss |

- $A_1$ capacity of the management
- $A_2$ number of employees
- $A_3$ localization
- $A_4$ company profit or loss

The objective is to induce decision rules explaining profit or loss on the basis of attributes $A_1$ $A_2$ and $A_3$ Let us observe that:

- Attribute $A_1$ is a criterion, because the evaluation with respect to the capacity of the management is preferentially ordered (high is better than medium and medium is better than low).
- Attribute $A_2$ is a quantitative attribute, because the values of the number of employees are not preferentially ordered (neither the high number of employees is generally better than the small number, nor the inverse). Similarity between companies is defined as follows: Company A is similar to Company B with respect to the attribute "number of employees" if:

$$\frac{\text{Employees of A} - \text{Employees of B}}{\text{Employees of B}} \leq 10\%$$

- Attribute $A_3$ is a qualitative attribute, because there is not a preferential order between types of localization: two companies are indiscernible with respect to localization if they have the same localization.
- Decision classes defined by attribute $A_4$ are preferentially ordered (trivially, profit is better than loss).

From Table 1, several decision rules can be induced. The following set of decision rules cover all the examples (within parentheses there are companies supporting the decision rule):

Rule 1. If the quality of the management is medium, then the company may have a profit or a loss (C3, C4).

Rule 2. If the quality of the management is (at least) high and the number of employees is similar to 700, then the company makes a profit (C1).

Rule 3. If the quality of the management is (at most) low, then the company has a loss (C5, C6).

Rule 4. If the number of employees is similar to 420 and the localization is B, then the company has a loss (C2).

Decision rules are based on elementary concepts and mathematical tools (sets and set operations, binary relations), without recourse to any algebraic or analytical structures. Principal relations involved in the construction of decision rules, like indiscernibility, similarity, and dominance, are natural and nonquestioned on practical grounds. Decision rule representation of knowledge is not a "black box," or arcane methodology, because the rules represent relevant information contained in data sets in a natural and comprehensible language, and examples supporting each rule are identifiable. Because contemporary decision problems are associated with larger and larger data sets, induction of decision rules showing the most important part of the available information is increasingly in demand.

*SEE ALSO:* Decision Making; Decision Support Systems

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## DECISION SUPPORT SYSTEMS

Decision support systems (DSS) are computer information systems that perform complex data analysis in order to help users make informed decisions. In general, a DSS retrieves information from a large data warehouse, analyzes it in accordance with user specifications, then publishes the results in a format that users can readily understand and use. DSS find application in a wide range of business settings, including investment portfolio management.

Portfolio management is one of the most essential problems in modern financial theory. It involves the construction of a portfolio of securities (stocks, bonds, treasury bills, etc.) that maximizes the investor's utility. The process leading to the construction of such a portfolio consists of two major steps. In the first step the decision-maker (investor, portfolio manager) has to evaluate the securities that are available as investment instruments. The vast number of available securities, especially in the case of stocks, makes this step necessary, in order to focus the analysis on a limited number of the best investment choices. Thus, on the basis of this evaluation stage the decision-maker selects a small number of securities that constitute the best investment opportunities. In the second step of the process the decision maker must decide on the amount of the available capital that should be invested in each security, thus constructing a portfolio of the selected securities. The portfolio should be constructed in accordance with the decision-maker's investment policy and risk tolerance.

The portfolio theory assumes that the decision-maker's judgment and investment policy can be represented by a utility function that is implicitly used by the decision-maker in making his investment decisions. Thus, the maximization of this utility function will result in the construction of a portfolio that is as consistent as possible with the decision-maker's expectations and investment policy. However, it is quite difficult to determine the specific form of this utility function.

The founder of portfolio theory, Nobelist Harry Markowitz, has developed a framework according to which the decision-maker's utility is a function of two variables, the expected return of the portfolio and its risk. Thus, he formulated the maximization of the decision-maker's utility as a two-objective problem: maximizing the expected return of the portfolio and minimizing the corresponding risk. To consider the return and the risk, Markowitz used two well-known statistical measures, the *mean* of all possible returns to estimate the return of the portfolio, and the *variance* to measure its risk. On the basis of this mean-variance framework, Markowitz has developed a mathematical framework to identify the efficient set of portfolios that maximizes returns at any given level of allowable risk. Given the risk aversion policy of the investor, it is possible to select the most appropriate portfolio from the efficient set.

This pioneering work of Markowitz motivated financial researchers to develop new portfolio management techniques, and significant contributions have been made over the last decades. The most significant of the approaches that have been proposed for portfolio management include the capital asset pricing model (CAPM), the arbitrage pricing theory (APT), single and multi index models, as well as several optimization techniques. Elton and Gruber's 1995 book *Modern Portfolio Theory and Investment Analysis* provides a comprehensive discussion of the various approaches.

### DECISION SUPPORT SYSTEMS IN PORTFOLIO MANAGEMENT

The concept of decision support systems (DSS) was introduced, from a theoretical point of view, in the late 1960s. DSS can be defined as computer information systems that provide information in a specific problem domain using analytical decision models and techniques, as well as access to databases, in order to support a decision maker in making decisions effectively in complex and ill-structured problems. Thus, the basic goal of DSS is to provide the necessary information to the decision-maker in order to help him or her get a better understanding of the decision environment and the alternatives available.

A typical structure of a DSS includes three main parts: the database, the model base, and the user

interface. The database includes all the information and data that are necessary to perform the analysis on the decision problem at hand. Data entry, storage, and retrieval are performed through a database management system. The model base is an arsenal of methods, techniques, and models that can be used to perform the analysis and support the decision-maker. These models or techniques are applied to the raw data in order to produce analysis or more meaningful output for the decision-maker. A model base management system is responsible for performing all tasks that are related to model management, such as model development, updates, storage, and retrieval. Finally, the user interface is responsible for the communication between the user and the system, while it further serves as a link between the database and the model base. The appropriate design of the user interface is a key issue towards the successful implementation of the whole system, so as to ensure that the user can take full advantage of the analytical capabilities that the system provides. Advances in computer hardware and software have enabled user-friendly graphical user interfaces (GUIs) to serve this function.

During the last four decades DSS have been developed and implemented to tackle a variety of real world decision-making problems, including financial problems and portfolio management. The portfolio management process involves the analysis of a vast volume of information and data, including financial, stock market, and macroeconomic data. Analyzing a continuous flow of such a vast amount of information for every available security in order to make real time portfolio management decisions is clearly impossible with out the support of a specifically designed computer system that will facilitate not only the data management process, but also the analysis.

Thus, the contribution of DSS to portfolio management becomes apparent. They provide an integrated tool to perform real-time analyses of portfolio management related data, and provide information according to the decision-maker's preferences. Furthermore, they enable the decision-maker to take full advantage of sophisticated analytic methods, including multivariate statistical and econometric techniques, powerful optimization methods, advanced preference modeling, and multiple-criteria decision-making techniques. DSS incorporating multiple-criteria decision-making methods in their structure are known as multicriteria DSS, and they have found several applications in the field of finance. Zopounidis, Godefroid, and Hurson have presented the methodological framework for the design and development of a multicriteria DSS for portfolio management. The use of such innovative tools in portfolio management decision making, together with the tools provided by the modern portfolio theory (CAPM, APT, etc.), provide the basis for improving the portfolio management process. The subsequent section illustrates the capabilities that a multicriteria DSS can provide in portfolio management through the presentation of the Investor system.

## PORTFOLIO MANAGEMENT DSS IN PRACTICE: AN ILLUSTRATION OF THE INVESTOR SYSTEM

The Investor system is a DSS designed and developed to support the portfolio management process and to help construct portfolios of stocks. The system includes a combination of portfolio theory models, multivariate statistical methods, and multiple criteria decision-making techniques for stock evaluation and portfolio construction. The structure of the system is presented in Figure 1.

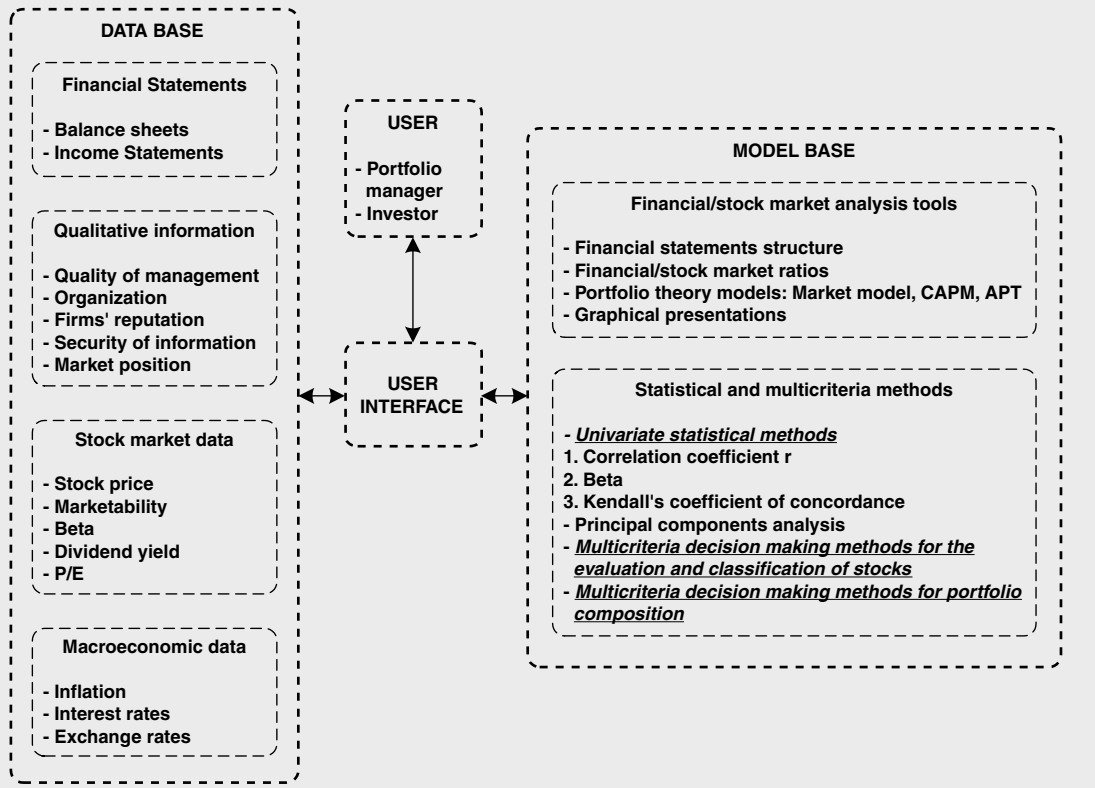
**FINANCIAL DATA.** The database of the system includes four types of information and data. The first involves the financial statements of the firms whose stocks are considered in the portfolio management problem. The balance sheet and the income statement provide valuable information regarding the financial soundness of the firms (e.g., sales, net profit, net worth, liabilities, assets, etc.). The system contains such financial data spanning a five-year period, so that users can reach informed conclusions about the firms' financial evolution.

**QUALITATIVE INFORMATION.** In addition to these financial data, information on some qualitative factors is also inserted in the database. The management of the firms, their organization, their reputation in the market, their technical facilities, and their market position affect directly the operation and the performance of the firms; thus, they constitute fundamental factors in the analysis of the firms whose stocks that are considered in the portfolio management problem.

**MARKET DATA.** The third type of information included in the database involves the stocks' market histories. This information involves the stock prices, the marketability of the stocks, their beta coefficient (a measure of risk representing the relationship between the changes in the price of individual stocks with the changes in the market), the dividend yield, the price/earnings ratio, and so forth.

**MACROECONOMIC DATA.** Finally, information regarding the macroeconomic environment is also included. Inflation, interest rates, exchange rates, and other macroeconomic variables have a direct impact on the performance of the stock market, thus potentially affecting any individual stock. The combination of this information with the financial and stock histories of individual firms enables portfolio managers to perform a global evaluation of the investment opportunities available, both in terms of their sensitivity and

**Figure 1**
**Structure of the INVESTOR System**



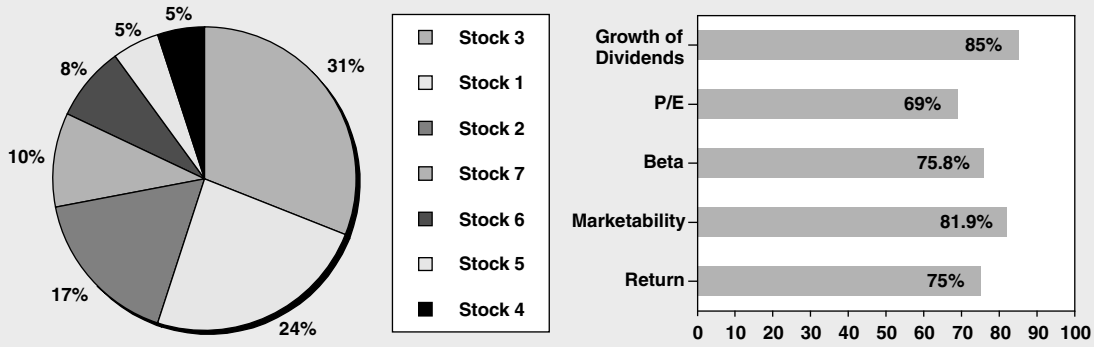

risk with respect to the economic environment, and to their individual characteristics.

**ANALYSIS TOOLS.** The analysis of all this information is performed through the tools incorporated in the system's model base. Two major components can be distinguished in the model base. The first one consists of financial and stock market analysis tools. These can analyze the structure of the financial statements of the firms, calculate financial and stock market ratios, apply well-known portfolio theory models (e.g., the market model, the CAPM, the APT), and present several graphical summaries of the results obtained through these tools to facilitate drawing some initial conclusions about the stocks' performance.

The second component of the model base involves more sophisticated analysis tools, including statistical and multiple-criteria decision-making techniques. More specifically, univariate statistical techniques are used to measure the stability of the beta coefficient of the stocks, while principal components analysis (a multivariate technique) is used to identify the most significant factors or criteria that describe the performance of the stocks, and to place the stocks into homogeneous groups according to their financial and stock market characteristics. The criteria identified as most crucial can be used to evaluate the stocks and thereby construct a portfolio that meets the investment policy of the investor/portfolio manager. Of course, the portfolio manager interacts with the system, and he or she can also introduce into the analysis the evaluation criteria that he or she considers important, even if these criteria are not found significant by principal components analysis.

The evaluation of the stocks' performance is completed through multiple-criteria decision-making

**Figure 2**
**Results of the Portfolio Construction Process**




| OBJECTIVES | ATTAINED VALUES |
|---|---|
| Return | 1.53 |
| Marketability | 0.61 |
| Beta | 0.79 |
| P/E | 12.53 |
| Growth of dividends per share | 51.34 |

methods. Multiple-criteria decision making is an advanced field of operations research that provides an arsenal of methodological tools and techniques to study real-world decision problems involving multiple criteria that often lead to conflicting results. The multiple-criteria decision-making methods that are incorporated in the model base of the Investor system enable the investor to develop an additive utility function that is fairly consistent with his or her investment policy, preferences, and experience. On the basis of this additive utility function a score (global utility) is estimated for each stock that represents its overall performance with respect to the selected evaluation criteria. The scores of the stocks are used as an index so they may be placed into appropriate classes specified by the user. Thus, the portfolio manager can develop an evaluation model (additive utility function) to distinguish, for instance, among the stocks that constitute the best investment opportunities, the stocks that do not have a medium-long term prospect but they can be considered only for the short run, and the stocks that are too risky and should be avoided. Of course, any other classification can be determined according to the objectives and the policy of the portfolio manager.

On the basis of this classification, the investor/portfolio manager can select a limited number of stocks to include in the actual portfolio, which represent the best investment opportunities. Constructing the portfolio is accomplished through multiple-criteria decision-making techniques that are appropriate for optimizing a set of objective functions subject to some constraints. The objective functions represent the investor/portfolio manager's objectives on some evaluation criteria (return, beta, marketability, etc.), while constraints can be imposed to ensure that the constructed portfolio meets some basic aspects of the investment policy of the investor/portfolio manager.

For instance, the investor/portfolio manager can introduce constraints on the amount of capital invested in stocks of specific business sectors, the amount of capital invested in high-risk or low-risk stocks (high and low $\beta$ coefficient, respectively), to determine a minimum level of return or a maximum level of risk, and so on. Once such details are determined, an interactive and iterative optimization procedure is performed that leads to the construction of a portfolio of stocks that meets the investor's investment policy and preferences. The results presented through the screen of Figure 2 show the proportion of each stock in the constructed portfolio, the performance of the portfolio on the specified evaluation criteria (attained values), as well as the rate of closeness (achievement rate) of the performance of the portfolio as opposed to the optimal values on each evaluation criterion (the higher this rate is, the closer the performance of the portfolio to the optimal one for each criterion).

Since the development of the portfolio theory in the 1950s, portfolio management has gained increasing interest within the financial community. Periodic turmoil in stock markets worldwide demonstrates the necessity for developing risk management tools that can be used to analyze the vast volume of information

that is available. The DSS framework provides such tools that enable investors and portfolio managers to employ sophisticated techniques from the fields of statistical analysis, econometric analysis, and operations research to make and implement real-time portfolio management decisions.

Recent research in this field has been oriented towards combining the powerful analytical tools used in the DSS framework with the new modeling techniques provided by soft computing technology (neural networks, expert systems, fuzzy sets, etc.) to address the uncertainty, vagueness, and fuzziness that is often encountered in the financial and business environment.

*SEE ALSO:* Competitive Intelligence; Computer Networks; Computer-Aided Design and Manufacturing; Management Information Systems; Strategic Planning Tools

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# DELEGATION

Delegation is the process of giving decision-making authority to lower-level employees. For the process to be successful, a worker must be able to obtain the resources and cooperation needed for successful completion of the delegated task. Empowerment of the workforce and task delegation are closely intertwined. Empowerment occurs when upper-level employees share power with lower-level employees. This involves providing the training, tools and management support that employees need to accomplish a task. Thus, an enabled worker has both the authority and the capability to accomplish the work. Although authority can be delegated, responsibility cannot-the person who delegates a task is ultimately responsible for its success. The assigned worker is therefore accountable for meeting the goals and objectives of the task.

## BENEFITS OF DELEGATION

Effective delegation can benefit the manager, the employee, and the organization. Perhaps the most important benefit for the company is a higher quality of work. Delegation can improve quality of work by allowing the employees who have direct knowledge of products and services to make decisions and complete tasks. Quality can also improve through enhanced employee motivation. Employees may do a better job because they feel a personal accountability for the outcome, even though responsibility ultimately rests with the individual who made the delegation. Motivation should also be enhanced as delegation enriches the worker's job by expanding the types of tasks that are involved in it.

Managers who delegate effectively also receive several personal benefits; most importantly, they have more time to do their own jobs when they assign tasks to others. Given the hectic nature of managerial work, time is a precious commodity. Effective delegation frees the manager to focus on managerial tasks such as planning and control. Managers also benefit from the development of subordinates' skills. With a more highly skilled workforce, they have more flexibility in making assignments and are more efficient decision makers. Managers who develop their workforce are also likely to have high personal power with their staff and to be highly valued by their organization.

## DRAWBACKS OF DELEGATION

Although delegation can provide benefits to the organization, many managers lack the motivation or knowledge to delegate effectively, and thus delegation (or lack of delegation) may be detrimental to the company. Managers' lack of motivation to delegate may be associated with a number of fallacies associated with delegations. Many managers believe that "if you want it done right, you have to do it yourself." While this is at times untrue, because the ultimate responsibility for a task lies with the manager, this attitude often prevents delegation. Other reasons for a lack of motivation to delegate are lack of trust in subordinates, fear of being seen as lazy, reluctance to take risks, and fear of competition from subordinates. Some of these barriers are correctable through management training and development, but others may not be easily overcome. Mangers may also lack the competencies necessary to delegate effectively. They may choose the wrong tasks

to delegate, the wrong subordinate to trust, or they may provide inadequate direction to the subordinate when delegating.

Improper delegation can cause a host of problems, primary of which is an incorrectly completed task, which may hurt the overall productivity of the organization. Additionally, the careers of the manager and subordinate may suffer. The manager is likely to take the blame for delegating the wrong task, delegating to the wrong person, or not providing proper guidance. The subordinate may also take the blame for doing the task incorrectly. Thus, poor delegation may detract from the personal success of managers and employees.

## PLANNING

Delegation is not difficult. Anyone can give an assignment to someone. However, effective delegation (assigning a task to the correct person) is a highly skilled process that requires planning, thought, and managerial skill.

**DEFINING SUCCESS.** Two planning activities should be undertaken before delegating an assignment: defining success and assessing qualifications needed. Defining success requires a determination of what will constitute successful performance on the assigned task. An effective delegator assigns workers to tasks on which they have a high probability of succeeding. If a manager can't identify the successful outcome of a task, how can that manager determine if a worker is capable of performing it? The failure to define success turns delegation into a gamble, rather than a prediction. An effective delegator makes a prediction of success based on the match between job requirements and the worker's competencies. An ineffective delegator hopes that the worker will be successful but really has no basis for this hope, since success has not been defined. If success is well defined and communicated to the subordinate, the worker has a clear understanding of the task requirements and can focus his/her efforts on important activities. Similarly, clearly defining success helps the delegator coach the worker, which further enhances the probability of a positive outcome.

There are two components to defining success. The first is to define the successful outcome of the task, and the second is to determine the appropriate processes needed to complete the task. Both are needed in order to make an effective delegation. For example, a manager might be considering assigning a different salesperson to a particularly difficult client. Prior to making the delegation, the manager should reflect on the desired outcomes from this assignment (e.g., increased sales, decreased complaints) and the types of processes (e.g., better client education, greater empathy) that might be needed to produce the desired result. Only after understanding what is needed can a rational delegation be made. Thus, managers should first ask themselves: "How will I judge the success of this delegation and what do I expect someone to do to be successful?"

**ASSESSING QUALIFICATIONS NEEDED.** The second step in planning delegation involves determining subordinate capabilities. There is always a choice in delegation, both as to which subordinates to delegate the assignment to, and whether to delegate the assignment at all. To make either decision, the manager needs to assess subordinate's capabilities. In making the assessment, a manager should ask, "What has this worker done to make me feel he or she will be effective on this assignment?" Managers should also ask themselves, "How do I think this person will perform on this assignment and why do I feel this way?" A worker could be effective in obtaining desired results, but could use an unacceptable process to obtain the results that negates the positive outcomes. Managers are very unlikely to make an accurate prediction of success for an assignment when they have no basis for the prediction. Thus, the better a manager knows a worker's past behaviors and accomplishments, the greater the chance of an effective future delegation. Often, however, managers have to delegate assignments to people who lack the relevant training or experience. The general process still applies in this situation, although the specific questions change. Here, the manager should carefully consider, "How has this person performed on previous assignments where he or she lacked training or experience?" Again, there must be a basis for the delegation, or it becomes a wild guess.

## PROCESS

The process of delegation is as critical as the planning, because a poor process can reduce the effectiveness of the delegation in several ways. First, it can lower the worker's motivation to perform the task. A qualified worker who is not motivated to complete the assignment is not likely to produce the desired results. Second, lack of proper communication of standards for the task may lead to less than desirable outcomes. Finally, the delegation process may create some artificial barriers or fail to eliminate others barriers to performance. The failure to share information and discuss real or perceived problems can reduce efficiency and may lead to failure. To avoid these obstacles, the following items should be considered when making an assignment.

**ALLOW EMPLOYEES TO PARTICIPATE IN THE DELEGATION PROCESS.** Employees who accept their assignments are much more likely to be committed to their success. This acceptance is enhanced when employees

have some say in the process. Thus, subordinates should be allowed to participate in determining when and how the delegated task will be accomplished and, when possible, what the assignment will be. At the most basic level, a manager can ask an employee if he or she is available to do a task, rather than telling him/her to do it. Participation can also increase supervisor/subordinate communication, which may minimize problems due to misunderstandings.

**SPECIFY STANDARDS.** Many communication problems occur because of the failure to clearly consider and specify the performance standards of the assignment. Some of the things to consider include the limitations of a subordinate's tasks, (e.g., gathering information only, or making a decision), their expected level of performance, their deadlines for reporting, and the constraints under which they will be operating. Where subordinates are given a choice in accepting the assignment, these issues should be discussed and negotiated prior to the delegation. Even when subordinates do not have the option of rejecting the assignment, these issues should be clearly described and subordinates should be asked for their input.

**BALANCE RESPONSIBILITY AND AUTHORITY.** A typical delegation error is to delegate work but avoid matching the responsibilities with the freedom to make decisions and the authority to implement them. This creates frustration, since the subordinate knows what needs to be done and how to do it, but is not given the opportunity to do it. Managers can avoid this problem by communicating to all individuals affected by the assignment that it has been delegated and who has the authority to complete the work. Managers can ask subordinates what resources they need for a task ad then empower them to secure those resources.

In addition to providing authority, managers should also provide adequate support for the delegated task. This might involve continually providing important information and feedback that are needed to accomplish the task. Finally, managers should publicly bestow credit when the task has been accomplished. This will enhance the subordinate's motivation and authority for future assignments. It also provides an important message to others that successful completion of tasks is acknowledged and rewarded.

**DELEGATE CONSISTENTLY.** Some managers delegate only when they are overworked or in a crisis. This can send a message to subordinates that they are being used since they only receive assignments when it benefits the manager. Ideally, delegation should benefit both the subordinate and the manager. Managers can send this message by delegating assignments that develop or stretch subordinates' talents and skills. Delegating to develop workers builds up a pool of talent for those inevitable crisis situations. It also enhances worker motivation and confidence since they acquire experience and benefit from the new or improved skills. Care should be taken to assure that the employee has the capability to succeed in the assignment. Employees should not be set up to fail. Certainly some failure will occur. Managers must recognize this and provide helpful, developmental feedback in those situations. Emphasis should be placed on the positive things that were done on the assignment and what actions could have been taken to overcome the problems.

**BALANCE THE ASSIGNMENTS.** Managers need to ensure that delegation isn't viewed as getting someone else to do their dirty work. Thus, an effective manager should delegate the pleasant and the unpleasant, the challenging and the boring assignments. Similarly, assignments should be balanced across workers. For example, it is quite common for managers to delegate the most unpleasant task to the best worker since that person can be counted on to do a good job. Alternatively, a poor worker may avoid receiving an unpleasant assignment due to the poor quality of the final product. This type of situation quickly sends the message to the productive worker that the way to get out of receiving unpleasant assignments is to lower the quality of his/her work. One way to avoid this problem is to give the productive worker other rewards and/or to increase the number of unpleasant assignments to the unproductive worker until the quality of the result improves.

**FOCUS ON RESULTS.** Once the task has been delegated, managers need to allow subordinates the freedom to make the choices needed to accomplish the task. Managers should not supervise too closely for this may create frustration and make someone feel that the manager lacks confidence in their ability. Managers should review and evaluate the results of the assignment, not the means used to accomplish the task. However, managers are responsible for making sure that both the process and the outcome of the delegated task are consistent with the goals. As noted, one way to accomplish this is through the specification of clear standards prior to the delegation. The manager needs to remember these standards and intervene only when they have been violated. Managers should avoid the tendency to intervene simply due to style differences. One of the benefits of allowing subordinates to make their own choices is that this can be an important source of innovation for the organization. Sometimes employees really have a better way.

## GROUP VS. INDIVIDUAL DELEGATION

A particular assignment can be delegated to an individual or a group of individuals. Additionally, a manager may not wish to delegate the whole task, but to participate as a member of the team. What are the

considerations in individual versus group delegation or even participation? Perhaps the most important point is that all of the previous issues apply. Prior to making the assignment, the manager must define success and assess the capabilities of the individual or group. In making the assignment, the individual or group should be allowed to participate as much as possible, authority and responsibilities should be balanced, standards should be specified and the manager should focus on results.

One difference between individual and group delegation is that individual behavior is typically easier to control and monitor. One alternative to delegating the assignment and giving entirely to a subordinate is for a manager to participate in the process as a group member. The downside of this approach is that it may send the group an unintended message of a lack of trust. Employees may feel that the manager is not there to contribute, but to check on the quality of their work. Thus, managers should carefully review their own capabilities as a team member and answer the question, "What do I add to this group to accomplish this task?" The answer to this question should be clearly communicated to the group so they understand why the manager has undertaken a role in the group. Finally, a manager should carefully assess the group's past behavior and have a reason for predicting that the group can accomplish the task. Again, this should be a prediction, not a gamble or wish for success.

## UPWARD DELEGATION

Many employees have become skilled in delegating to their supervisors. Upward delegation occurs when an employee shifts his or her assignment to a manager at a level above. This is not always easy, but is best done when a person feels that he or she lacks the skill or direction for a particular project, but that the manager above has the capabilities to perform the task. Upward delegation may start by asking the manager questions or asking for advice in help in solving a particular problem. If the manager feels that the employee has too many questions or needs too much assistance, the manager may rescind the delegation and remove task from the employee. If employees are avoiding delegated duties by overwhelming the manager with requests for assistance, the manager can require that the employee have at least one proposed solution to every problem brought to the manager. Additionally, this situation can be improved by the manager asking questions, which lead the worker to think through and resolve a problem. Questions like, "What would you do next? What do you see as our options?" and, "What do you see as the best approach?" communicate the message that the employee is expected to take the initiative to at least attempt to solve the assignment.

A manager who uses effective delegation across time and assignments will be more efficient and have more time for true managerial work and will reap the benefits of employee empowerment at the same time. This will occur because success will be clearly defined and communicated to a worker who will be matched with jobs based on his or her capabilities. When done correctly, the process of delegation empowers workers and enhances their motivation and commitment.

*SEE ALSO:* Management Styles; Motivation and Motivation Theory; Time Management

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# DEREGULATION

Deregulation refers to the deletion, abandonment, or relaxation of various laws, rules, and regulations that affect business and industry. However, the topic of deregulation is best understood by first understanding the purposes and effects of regulations.

## REGULATION

It is often thought that individual firms lack the perspective and/or the incentive to protect society. Consequently, the regulation of business and industry by government is for the purposes of consumer protection and or the enhancement of business competition. Regulation is generally thought to also protect minorities, employees, investors, and the environment.

The railroad industry was one of the first industries that the federal government targeted. As a result, the Interstate Commerce Act was passed in 1887. As such, the Interstate Commerce Act created the first regulatory body in the United States—the Interstate Commerce Commission, which still regulates transportation rates, as well as establishes rules and regulations for interstate commerce.

The United States government expanded its control over industry by focusing on trusts, where a company is established for the purpose of controlling multiple companies. Consequently, the Sherman Antitrust Act was enacted in 1890 to control monopolies. In 1914, the Clayton Act amended the Sherman Act by forbidding specific business actions. For example, tying contracts interlocking directorates, and discriminatory pricing were made illegal if the results of these actions lessened competition.

The Federal Trade Commission Act, also enacted in 1914, formally established the Federal Trade Commission (FTC). Among other responsibilities, the FTC remains responsible for defining, detecting, and enforcing compliance with the Clayton Act. The Wheeler-Lea Act of 1938 expanded FTC jurisdiction to include any practice or practices that harm the public in general and those practices that harm competitors. The Robinson-Patman Act was enacted in 1938 due to the growth of large retailing conglomerates. This law covered discrimination against buyers as well as sellers.

In 1958 the National Traffic and Safety Act was enacted. This legislation provided for the creation of compulsory safety standards for automobiles and tires.

In 1966 the Fair Packaging and Labeling Act was passed. This act provided for the regulation of the packaging and labeling of consumer goods. It also required manufacturers to state package contents, the maker of the contents, and how much of individual contents are included.

The Antitrust Procedures and Penalties Act was enacted in 1974. This legislation increased fines for violation of the Sherman Act. Two years later, the Antitrust Improvement Act required firms to notify the FTC of merger plans. This act also gave state attorneys general the power to sue for the benefit of consumers.

## GOVERNMENT PERMISSIVENESS

It is generally thought that the permissiveness of the federal government began during the presidency of Richard M. Nixon, which led the way for formal deregulation. During the 1980s the government turned its focus from laws, rules, and regulations to the creation of market incentives that were thought to motivate business.

Proponents of deregulation argue that government intervention impedes the natural laws of supply and demand and ultimately increases costs to consumers. In addition, the overregulation of business is thought to thwart innovation by creating delays and increased red tape. Thus in 1981 the Ronald Reagan administration created the Task Force on Regulatory Relief to review all proposed new regulations and review old regulations. The establishment of this task force also lead to the increased use of cost-benefit analysis, which compares the cost of all regulations to their benefit.

Other steps toward deregulation, as adapted from a summary in *Business Today,* by David Rachman and Michael H. Mescon (1987), are presented below.

1968. The Supreme Court allows non-AT&T equipment to be hooked up with the AT&T system (Carterfone decision).

1969. The Federal Communications Commission (FCC) lets MCI connect its long-distance network with local phone systems.

1970. The Federal Reserve lifts interest rate ceilings on bank deposits over $100,000 and with maturities less than six months.

1974. The Justice Department files an antitrust suit against AT&T.

1975. The Securities and Exchange Commission (SEC) stops stockbrokers from charging fixed commissions.

1977. Financial management and advice firm Merrill Lynch is allowed to enter into more direct competition with commercial banks with the debut of its cash management account.

1978. Congress deregulates the airline industry.

1979. The FCC permits AT&T to sell nonregulated services such as data processing.

1980. Congress deregulates the trucking and railroad industries.

1981. Sears Roebuck is allowed to offer one-stop financial shopping for insurance, brokerage services, and banking.

1982. Congress deregulates intercity bus services.

1984. AT&T is disbanded, leaving local telephone companies to operate separately from the long-distance company.

## RECENT TRENDS

The debate over the advantages and disadvantages of deregulation continue to the present. For example, the future direction of U.S. aviation policy is continually debated, even though the United Stated deregulated the airline industry in 1978. Proponents of the Airline Deregulation Act of 1978 point to specific benefits of the free-market environment. For instance, the percentage of the population taking trips by air doubled between 1978 and 1997. In addition, the number of airlines operating in the United States more

than doubled (from 43 to 90). Advocates of regulation, however, regularly refer to the bankruptcies of Pan American World Airways and Eastern Airlines as negative consequences of deregulation. Unfortunately, increased competition did not guarantee success for airlines, and many failed to adapt their business processes to the decrease in revenues from lower fare prices. Also, an already weak airline industry was severely affected by the September 11, 2001 terrorist attacks, and lead more of the major air carriers to financial trouble.

Telephone service deregulation, as a result of the Telecom Reform Act of 1996, also receives a great deal of attention. Proponents of telecommunications deregulation point to lower prices, better quality, and greater choices to users. However, advocates of regulation indicate that the larger long-distance carriers are still in control. Recent mergers and acquisitions support this trend towards larger long-distance carriers.

## GLOBAL DEREGULATION

Deregulation is not limited to the United States. Europe has created a few low-cost, no-frills air carriers—a deregulation outcome cited by the United Kingdom's Civil Aviation Authority as the most "striking" development in European airline competition in years. Elsewhere in Europe, telecommunications, postal services, and railways have also undergone significant changes in recent years. The changes in these basic infrastructure services include reorganization reforms, as well as privatization of publicly owned industries.

## DEREGULATION AND THE FUTURE

Deregulation issues continue to arise in transportation, energy, banking, broadcasting, and cable. Recent competition in the cable and telephone industries has warranted a backtracking of deregulation efforts by the FCC as potentially counterproductive to the market's development.

A chief concern with business legislation is the cost. That is, at what point does the cost of legislation outweigh the benefits? This cost-benefit question, first posed during the Reagan administration, is likely to persist. However, as products and services become more complex due to rapid technological change, various public constituencies are likely to ask for new regulations, and individual companies and industry groups will be required to maintain surveillance of current and pending legislation.

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# DICTIONARY OF OCCUPATIONAL TITLES

*SEE:* Occupational Information Network

# DISCRIMINATION

Discrimination, in an employment context, can be generally defined as treating an individual or group less well in recruiting, hiring, or any other terms and conditions of employment due to the person's or group's race, color, sex, religion, national origin, age, disability, or veteran's status. These categories are referred to as protected classifications because they are singled out for protection by equal employment opportunity (EEO) laws. Subcategories of people within each protected classification are referred to as protected groups. For example, male and female are the protected groups within the protected classification of sex. EEO legislation affords protection from illegal discrimination to all protected groups within a protected classification, not just the minority group. Thus, employment discrimination against a man is just as unlawful as that aimed at a woman. The lone exception to this rule concerns the use of affirmative action programs (discussed later), which, under certain circumstances, allow employers to treat members of certain protected groups preferentially.

In the U.S., effective federal legislation banning employment-related discrimination did not exist until

the 1960s, when Congress passed Title VII of the Civil Rights Act (1964). In the years since, several other important federal laws have been passed. In addition to the myriad federal laws banning discrimination on the basis of race, color, sex, religion, national origin, age, disability, and veteran's status, almost all states have anti-discrimination laws affecting the workplace. Most of these laws extend the protections in federal law to employers that are not covered by the federal statutes because of their size (Title VII for example, applies only to employers with 15 or more employees). Some state laws also attempt to prevent discrimination against individuals and groups that are not included in federal law. For example, approximately 14 states have passed statutes protecting all workers in the states from employment discrimination based on sexual orientation and several others states prohibit public sector employers from discriminating on the basis of sexual orientation.

## SPECIFIC ANTI-DISCRIMINATION LEGISLATION AFFECTING THE WORKPLACE

Title VII of the Civil Rights Act (CRA), passed in 1964, covers organizations that employ 15 or more workers for at least 20 weeks during the year. Specifically, the law states: "It shall be an unlawful employment practice for an employer to fail or refuse to hire or discharge any individual, or otherwise to discriminate against any individual with respect to his compensation, terms, conditions, or privileges of employment, because of such individual's race, color, religion, sex, or national origin." Interpretations of Title VII by courts have clarified the specific meaning of the prohibitions against discrimination. In general, it is safe to say that virtually any workplace decision involving personnel is subject to legal challenge on the basis of Title VII, including not only decisions made relative to recruiting and hiring, but also in relation to promotion, discipline, admission to training programs, layoffs, and performance appraisal. Harassment of applicants or employees because of their membership in a protected classification is also considered a violation of Title VII.

Title VII is probably the most valuable tool that employees have for remedying workplace discrimination because it covers the greatest number of protected classifications. If a court determines that discrimination has occurred, this law entitles the victim to relief in the form of legal costs and back pay (i.e., the salary the person would have been receiving had no discrimination occurred). For instance, suppose a woman sues a company for rejecting her application for a $35,000 per year construction job because the company unlawfully excludes women from this job. The litigation process takes two years and, ultimately, the court rules in the applicant's favor. To remedy this discrimination, the court could require the company to pay her legal fees and grant her $70,000 in back pay (two years' salary).

Title VII of the Civil Rights Act of 1964 has had an enormous impact on the human resource management (HRM) practices of many companies, by forcing them to take a close look at the way they recruit, hire, promote, award pay raises, and discipline their employees. As a result of this self-scrutiny, many firms have changed their practices, making them more systematic and objective. For instance, most firms now require their supervisors to provide detailed documentation to justify the fairness of their disciplinary actions, and many firms are now more cautious with regard to their use of employment tests that restrict the employment opportunities for certain protected groups.

A number of Supreme Court decisions in the mid- to late 1980s made discrimination claims under Title VII more difficult for employees to substantiate. To put more teeth into the law, Congress amended it by enacting the Civil Rights Act of 1991. This 1991 amendment expanded the list of remedies that may be awarded in a discrimination case-the employer now has more to lose if found guilty of discrimination. In addition to legal fees and back pay, an employer may now be charged with punitive and compensatory damages (for future financial losses, emotional pain, suffering, inconvenience, mental anguish, and loss of enjoyment of life). The cap for these damages ranges from $50,000 to $300,000 depending on the size of the company. Employees are entitled to such damages in cases where discrimination practices are "engaged in with malice or reckless indifference to the legal rights of the aggrieved individual" (e.g., the employer is aware that serious violations are occurring, but does nothing to rectify them).

Moreover, the CRA of 1991 adds additional bite to the 1964 law by providing a more detailed description of the evidence needed to prove a discrimination claim, making such claims easier to prove. The CRA of 1991 also differs from the 1964 law by addressing the issue of mixed-motives cases. The CRA of 1991 states that mixed-motive decisions are unlawful. That is, a hiring practice is illegal when a candidate's protected group membership is a factor affecting an employment decision, even if other, more legitimate factors are also considered. For instance, a company rejects the application of a woman because she behaves in an "unlady-like" manner-she is "too aggressive for a woman, wears no makeup, and swears like a man." The company is concerned that she would offend its customers. The employer's motives are thus mixed: its concern about offending customers is a legitimate motive; its stereotyped view of how a "lady" should behave is a discriminatory one.

## OTHER MAJOR EEO LAWS

The Equal Pay Act of 1963 prohibits discrimination in pay on the basis of sex when jobs within the same company are substantially the same. The company is allowed to pay workers doing the same job differently if the differences are based on merit, seniority, or any other reasonable basis other than the workers' gender.

The Age Discrimination in Employment Act (ADEA) of 1967 bans employment discrimination on the basis of age by protecting applicants and employees who are 40 or older. The ADEA applies to nearly all employers of 20 or more employees. The ADEA protects only older individuals from discrimination; people under 40 are not protected. The act also prohibits employers from giving preference to individuals within the 40 or older group. For instance, an employer may not discriminate against a 50-year-old by giving preference to a 40-year-old. Except in limited circumstances, companies cannot require individuals to retire because of their age.

The Vocational Rehabilitation Act of 1973, a precursor to the 1990 passage of the Americans with Disabilities Act, requires employers who are federal contractors ($2,500 or more) to take proactive measures to employ individuals with disabilities. This law is limited in application since it only applies to federal agencies and businesses doing contract work with the government.

The Vietnam Veterans' Readjustment Assistance Act, passed in 1974, requires employers who are government contractors ($10,000 or more) to take proactive steps to hire veterans of the Vietnam era. The scope of this law is also limited by the fact that only government contractors must comply.

The Pregnancy Discrimination Act of 1978 amended the CRA of 1964 by broadening the interpretation of sex discrimination to include pregnancy, childbirth, or related medical conditions. It prohibits discrimination against pregnant job applicants or against women who are of child-bearing age. It states that employees who are unable to perform their jobs because of a pregnancy-related condition must be treated in the same manner as employees who are temporarily disabled for other reasons. It has also been interpreted to mean that women cannot be prevented from competing for certain jobs within a company just because the jobs may involve exposure to substances thought harmful to the reproductive systems of women.

The Immigration Reform and Control Act (IRCA) of 1986 prohibited discrimination based on national origin and citizenship. Specifically, the law states that employers of four or more employees cannot discriminate against any individual (other than an illegal alien) because of that person's national origin or citizenship status. In addition to being an anti-discrimination law, this act makes it unlawful to knowingly hire an unauthorized alien. At the time of hiring, an employer must require proof that the person offered the job is not an illegal alien.

The Americans with Disabilities Act (ADA) of 1990 was designed to eliminate discrimination against individuals with disabilities. The employment implications of the act, which are delineated in Titles I (private sector) and II (public sector) of the ADA, affect nearly all organizations employing 15 or more workers. According to the act, an individual is considered disabled if he or she has a physical or mental impairment which substantially limits one or more of the individual's major life activities, such as walking, seeing, hearing, breathing, and learning, as well as the ability to secure or retain employment. In the years since passage of the legislation, the courts have applied a fairly broad definition of disability. The ADA only protects qualified individuals with a disability. To win a complaint, an individual who has been denied employment because of a disability must establish that, with accommodation (if necessary), he or she is qualified to perform the essential functions of the job in question. To defend successfully against such a suit, the employer must demonstrate that, even with reasonable accommodation, the candidate could not perform the job satisfactorily, or it must demonstrate that the accommodation would impose an undue hardship. The ADA defines "undue hardship" as those accommodations that require significant difficulty to effect or significant expense on the part of the employer.

An example of an ADA case would be one in which an employee is fired because of frequent absences caused by a particular disability. The employee may argue that the employer failed to offer a reasonable accommodation, such as a transfer to a part-time position. The employer, on the other hand, may argue that such an action would pose an undue hardship in that the creation of such a position would be too costly.

## INTERPRETING EEO LAW

It is clear from the preceding discussion that an employer may not discriminate on the basis of an individual's protected group membership. But exactly how does one determine whether a particular act is discriminatory? Consider the following examples:

*Case 1:* A woman was denied employment as a police officer because she failed a strength test. During the past year that test screened out 90 percent of all female applicants and 30 percent of all male applicants.

*Case 2:* A woman was denied employment as a construction worker because she failed

to meet the company's requirement that all workers be at least 5 feet 8 inches tall and weigh at least 160 pounds. During the past year, 20 percent of the male applicants and 70 percent of the female applicants have been rejected because of this requirement.

*Case 3:* A female accountant was fired despite satisfactory performance ratings. The boss claims she has violated company policy by moonlighting for another firm. The boss was heard making the comment, "Women don't belong in accounting, anyway."

*Case 4:* A male boss fired his female secretary because he thought she was too ugly, and replaced her with a woman who, in his opinion, was much prettier.

The Civil Rights Acts of 1964 and 1991 prohibit sex discrimination. Yet, knowing that sex discrimination is unlawful provides very little guidance in these cases. For instance, how important are the intentions of the employer? And how important are the outcomes of the employment decisions? In the first two cases, the employer's intentions seem to be noble, but the outcomes of the employment decisions were clearly disadvantageous to women. In the third case, the employer's intentions appear questionable, but the outcome may be fair. After all, the employee did violate the company policy. In the fourth case, the employer's intentions are despicable, yet the outcome did not adversely affect women in the sense that another member of her sex replaced the discharged employee.

To determine whether an EEO law has been violated, one must know how the courts define the term *discrimination.* In actuality, there are two definitions: disparate treatment and disparate impact. Disparate treatment is intentional discrimination. It is defined as treating people unfairly based on their membership in a protected group. For example, the firing of the female accountant in Case 3 would be an example of disparate treatment if the discharge were triggered by the supervisor's bias against female accountants (i.e., if men were not discharged for moonlighting). However, the employer's actions in Cases 1 and 2 would not be classified as disparate treatment because there was no apparent intent to discriminate.

While disparate treatment is often the result of an employer's bias or prejudice toward a particular group, it may also occur as the result of trying to protect the group members' interests. For instance, consider the employer who refuses to hire women for dangerous jobs in order to protect their safety. While its intentions might be noble, this employer would be just as guilty of discrimination as one with less noble intentions.

What about Case 4, where a secretary was fired for being too ugly? Is the employer guilty of sex discrimination? The answer is no if the bias displayed by the boss was directed at appearance, not sex. Appearance is not a protected classification. The answer is yes if the appearance standard were being applied only to women; that is, the company fired women but not men on the basis of their looks.

Disparate impact is unintentional discrimination, defined as any practice without business justification that has unequal consequences for people of different protected groups. This concept of illegal discrimination was first established by the Griggs v. Duke Supreme Court decision, handed down in 1971. Disparate impact discrimination occurs, for instance, if an arbitrary selection practice (e.g., an irrelevant employment test) resulted in the selection of a disproportionately low number of females or African Americans. The key notion here is "arbitrary selection practice." If the selection practice were relevant or job-related, rather than arbitrary, the employer's practice would be legal, regardless of its disproportionate outcome. For example, despite the fact the women received the short end of the stick in Cases 1 and 2, the employer's actions would be lawful if the selection criteria (e.g., the strength test and height and weight requirements) were deemed job related. As it turns out, strength tests are much more likely to be considered job related than height and weight requirements. Thus, the employer would probably win Case 1 and lose Case 2.

## AFFIRMATIVE ACTION

The aim of affirmative action is to remedy past and current discrimination. Although the overall aim of affirmative action is thus identical to that of EEO (i.e., to advance the cause of protected groups by eliminating employment discrimination), the two approaches differ in the way they attempt to accomplish this aim. EEO initiatives are color-blind, while affirmative action initiatives are color-conscious. That is, affirmative action makes special provisions to recruit, train, retain, promote, or grant some other benefit to members of protected groups (e.g., women, blacks).

In some cases, employers are legally required to institute affirmative action programs. For instance, Executive Order 11246, issued by President Lyndon Johnson, makes such programs mandatory for all federal government contractors. Affirmative action can also be court ordered as part of a settlement in a discrimination case. For example, in the 1970s, the state of Alabama was ordered by the Supreme Court to select one black applicant for each white hired as a state trooper. The purpose of this decree was to rectify the effects of past discrimination that had been blatantly occurring for several years.

## Exhibit 1
### Affirmative Action Options

**Always Legal**

1. Do nothing special, but make sure you always hire and promote people based solely on qualifications.
2. Analyze workforce for underutilization.
3. Set goals for increasing the percentage of minorities employed in jobs for which they are underutilized.
4. Remove artificial barriers blocking the advancement of minorities.
5. Create upward mobility training programs for minorities.
6. Advertise job openings in a way that ensures minority awareness (e.g., contact the local chapter of NOW or the NAACP).
7. Impose a rule that states that a manager cannot hire someone until there is a qualified minority in the applicant pool.

**Sometimes Legal**
**(depends on the severity of the under-utilization problem)**

8. Impose a rule that when faced with two equally qualified applicants (a minority and non-minority), the manager must hire the minority candidate.
9. Impose a rule that when faced with two qualified applicants (a minority and non-minority), hire the minority even if the other candidate has better qualifications.
10. Set a hiring quota that specifies one minority hiring for every non-minority hiring.

**Never Legal**

11. Do not consider any non-minorities for the position. Hire the most qualified minority applicant.
12. Fire non-minority employee and replace him or her with a minority applicant.

Most firms, however, are under no legal obligation to implement affirmative action programs. Those choosing to implement such programs do so voluntarily, believing it makes good business sense. These firms believe that by implementing affirmative action they can (1) attract and retain a larger and better pool of applicants, (2) avoid discrimination lawsuits, and (3) improve the firm's reputation within the community and its consumer base.

Affirmative action implementation consists of two steps. First, the organization conducts an analysis to identify the underutilized protected groups within its various job categories (e.g., officials and managers, professionals, service workers, sales workers). It then develops a remedial plan that targets these underutilized groups. A utilization analysis is a statistical procedure that compares the percentage of each protected group for each job category within the organization to that in the available labor market. If the organizational percentage is less than the labor-market percentage, the group is classified as being underutilized.

For example, the percentage of professionals within the organization who are women would be compared to the percentage of professionals in the available labor market who are women. The organization would classify women as being underutilized if it discovered, for instance, that women constitute 5 percent of the firm's professionals, and yet constitute 20 percent of the professionals in the available labor market.

The second step is to develop an affirmative action plan (AAP) that targets the underutilized protected groups. An AAP is a written statement that specifies how the organization plans to increase the utilization of targeted groups. The AAP consists of three elements: goals, timetables, and action steps.

An AAP goal specifies the percentage of protected group representation it seeks to reach. The timetable specifies the time period within which it hopes to reach its goal. For example, an AAP may state: "The firm plans to increase its percentage of female professionals from 5 to 20 percent within the next five years."

The action steps specify how the organization plans to reach its goals and timetables. Action steps typically include such things as intensifying recruitment efforts, removing arbitrary selection standards, eliminating workplace prejudices, and offering employees better promotional and training opportunities. An example follows of a set of action steps:

- Meet with minority and female employees to request suggestions.
- Review present selection and promotion procedures to determine job-relatedness

- Design and implement a career counseling program for lower level employees to encourage and assist in planning occupational and career goals.
- Install a new, less subjective performance appraisal system.

When a company initiates an AAP as a remedy for under-utilization, it attempts to bring qualified women or minorities into the workplace to make it more reflective of the population from which the employees are drawn. This practice sometimes involves the use of preferential treatment or giving members of underutilized groups some advantage over others in the employment process. The use of preferential treatment has triggered a storm of controversy, as detractors point to the seemingly inherent lack of fairness in giving preference to one individual over another based solely on that person's race or gender. Supporters, however, believe that preferential treatment is sometimes needed to level the playing field. The U.S. Supreme Court has ruled that preferential treatment is legal if engaged in as part of a bona fide affirmative action program that is designed to remedy underutilization. The AAP, however, must be temporary, flexible, and reasonable as noted in Exhibit 1.

*SEE ALSO:* Affirmative Action; Employee Recruitment Planning; Employee Screening and Selection; Employment Law and Compliance

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## DISTRIBUTION AND DISTRIBUTION REQUIREMENTS PLANNING

A supply channel is composed of three structures. At one end of the channel is the manufacturer. The manufacturer focuses on the development and production of products and originates the distribution process. The terminal point in the channel is the retailer who sells goods and services directly to the customer for their personal, non-business use. In between the two lies a process called distribution, which is more difficult to define. One involved in the distribution process is labeled a "distributor." The *APICS Dictionary* describes a distributor as "a business that does not manufacture its own products but purchases and resells these products. Such a business usually maintains a finished goods inventory." The proliferation of alternative distribution forms, such as warehouse clubs, catalog sales, marketing channel specialists, and mail order, have blurred functional distinctions and increased the difficulty of defining both the distribution process and the term distributor.

One ultimately could maintain that distributors include all enterprises that sell products to retailers and other merchants—and/or to industrial, institutional, and commercial users—but do not sell in significant amounts to the ultimate customer. According to this definition, most companies that are involved with the disbursement of raw materials and finished products belong, in one sense or another, to the distribution industry. By adopting this definition, distribution is expanded to cover nearly every form of materials management and physical distribution activity performed by channel constituents, except for the processes of manufacturing and retailing.

Distribution involves a number of activities centered around a physical flow of goods and information. At one time the term distribution applied only to the outbound side of supply chain management, but it now includes both inbound and outbound. Management of the inbound flow involves these elements:

- Material planning and control
- Purchasing
- Receiving
- Physical management of materials via warehousing and storage
- Materials handling

Management of the outbound flow involves these elements:

- Order processing
- Warehousing and storage
- Finished goods management

- Material handling and packaging
- Shipping
- Transportation

Distribution channels are formed to solve three critical distribution problems: functional performance, reduced complexity, and specialization.

The central focus of distribution is to increase the efficiency of time, place, and delivery utility. When demand and product availability are immediate, the producer can perform the exchange and delivery functions itself. However, as the number of producers grows and the geographical dispersion of the customer base expands, the need for both internal and external intermediaries who can facilitate the flow of products, services, and information via a distribution process increases.

Distribution management also can decrease overall channel complexity through sorting and assistance in routinization. Sorting is the group of activities associated with transforming products acquired from manufacturers into the assortments and quantities demanded in the marketplace. Routinization refers to the policies and procedures providing common goals, channel arrangements, expectations, and mechanisms to facilitate efficient transactions. David F. Ross describes sorting as including four primary functions:

1. Sorting is the function of physically separating a heterogeneous group of items into homogeneous subgroups. This includes grading and grouping individual items into an inventory lot by quality or eliminating defects from the lot.
2. Accumulating is the function of combining homogeneous stocks of products into larger groups of supply.
3. Allocation is the function of breaking down large lots of products into smaller salable units.
4. Assorting is the function of mixing similar or functionally related items into assortments to meet customer demand. For example, putting items into kit form.

As the supply chain grows more complex, costs and inefficiencies multiply in the channel. In response, some channels add or contain partners that specialize in one or more of the elements of distribution, such as exchange or warehousing. Specialization then improves the channel by increasing the velocity of goods and value-added services and reducing costs associated with selling, transportation, carrying inventory, warehousing, order processing, and credit.

## ROLE OF THE DISTRIBUTION FUNCTION

There are a number of critical functions performed by the channel distributor. Ross describes these functions as:

1. Product acquisition. This means acquiring products in a finished or semi-finished state from either a manufacturer or through another distributor that is higher up in the supply channel. These functions can be performed by independent channel intermediaries or by the distribution facilities of manufacturing companies.
2. Product movement. This implies significant effort spent on product movement up or down the supply channel.
3. Product transaction. Distributors can be characterized as selling products in bulk quantities solely for the purpose of resale or business use. Downstream businesses will then sell these products to other distributors or retailers who will sell them directly to the end customer, or to manufacturers who will consume the material/components in their own production processes.

Following are the separate elements contained within the three critical functions of distribution:

- Selling and promoting. This function is very important to manufacturers. One strategy involves the use of distribution channels to carry out the responsibilities of product deployment. In addition to being marketing experts in their industry, distribution firms usually have direct-selling organizations and a detailed knowledge of their customers and their expectations. The manufacturer utilizing this distributor can then tap into these resources. Also, because of the scale of the distributing firm's operations and its specialized skill in channel management, it can significantly improve the time, place, and possession utilities by housing inventory closer to the market. These advantages mean that the manufacturer can reach many small, distant customers at a relatively low cost, thus allowing the manufacturer to focus its expenditures on product development and its core production processes.
- Buying and building product assortments. This is an extremely important function for retailers. Most retailers prefer to deal with few suppliers providing a wide assortment of products that fit their merchandizing strategy rather than many with limited product lines. This, of course, saves on purchasing,

transportation, and merchandizing costs. Distribution firms have the ability to bring together related products from multiple manufacturers and assemble the right combination of these products in quantities that meet the retailer's requirements in a cost-efficient manner.

- Bulk breaking. This is one of the fundamental functions of distribution. Manufacturers normally produce large quantities of a limited number of products. However, retailers normally require smaller quantities of multiple products. When the distribution function handles this requirement it keeps the manufacturer from having to break bulk and repackage its product to fit individual requirements. Lean manufacturing and JIT techniques are continuously seeking ways to reduce lot sizes, so this function enhances that goal.
- Value-added processing. Postponement specifies that products should be kept at the highest possible level in the pipeline in large, generic quantities that can be customized into their final form as close as possible to the actual final sale. The distributor can facilitate this process by performing sorting, labeling, blending, kitting, packaging, and light final assembly at one or more points within the supply channel. This significantly reduces end-product obsolescence and minimizes the risk inherent with carrying finished goods inventory.
- Transportation. The movement of goods from the manufacturer to the retailer is a critical function of distribution. Delivery encompasses those activities that are necessary to ensure that the right product is available to the customer at the right time and right place. This frequently means that a structure of central, branch, and field warehouses, geographically situated in the appropriate locations, are needed to achieve optimum customer service. Transportation's goal is to ensure that goods are positioned properly in the channel in a quick, cost-effective, and consistent manner.
- Warehousing. Warehousing exists to provide access to sufficient stock in order to satisfy anticipated customer requirements, and to act as a buffer against supply and demand uncertainties. Since demand is often located far from the source (manufacturer), warehousing can provide a wide range of marketplaces that manufacturers, functioning independently, could not penetrate.
- Marketing information. The distribution channel also can provide information regarding product, marketplace issues, and competitors' activities in a relatively short time.

## DRP

The need for more detailed distribution planning led to the emergence of distribution requirements planning (DRP) during the 1970s. DRP is a widely used and potentially powerful technique for helping outbound logistics systems manage and minimize inbound inventories. This concept extended the time-phase order point found in material requirements planning (MRP) logic to the management of channel inventory. By the 1980s DRP had become a standard approach for planning and controlling distribution logistics activities and had evolved into distribution resource planning. The concept now embraces all business functions in the supply channel, not just inventory and logistics, and is termed DRP II.

DRP is usually used with an MRP system, although most DRP models are more comprehensive than stand-alone MRP models and can schedule transportation. The underlying rationale for DRP is to more accurately forecast demand and then use that information to develop delivery schedules. This way, distribution firms can minimize inbound inventory by using MRP in conjunction with other schedules.

One of the key elements of DRP is the DRP table, which includes the following elements:

- Forecast demand for each stock-keeping unit (SKU)
- Current inventory level of the SKU
- Target safety stock
- Recommended replenishment quantity
- Replenishment lead time

The concept of DRP very closely mimics the logic of MRP. As with MRP, gross requirements consist of actual customer orders, forecasted demand, or some combination of both; scheduled receipts are the goods the distributor expects to receive from orders that already have been released, while goods that already are received and entered into inventory constitute the on-hand inventory balance. Subtracting scheduled receipts and on-hand inventory from gross requirements yields net requirements. Based upon the distributor's lot-sizing policy and receiving behavior, planned order receipts are generated. Firms may order only what they need for the next planning period or for a designated time period. Known as economic order quantity (EOQ), this involves a lot size based on a costing model. Alternatively, firms may be limited to multiples of a lot size simply because the supplying firm packages or palletizes their goods in standard quantities. Also, some distributors may require some

**Figure 1**
**A DRP Calculation**

| | |
|---|---|
| **Scheduled receipts:** | **1200, period 3** |
| **On-hand inventory balance:** | **1000** |
| **Lead time:** | **3 periods** |
| **Order receipt:** | **period due** |
| **Lot size:** | **600 units per pallet** |

| **Periods** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
|---|---|---|---|---|---|---|---|---|
| **Gross Requirements** | **500** | **500** | **500** | **500** | **500** | **500** | **500** | **500** |
| **Scheduled Receipts** | | | **1200** | | | | | |
| **On Hand** | **500** | | | **200** | | | | |
| **Net Requirements** | | | | | **300** | **200** | **100** | |
| **Planned Order Receipt** | | | | | **600** | **600** | **600** | |
| **Planned Order Release** | | **600** | **600** | **600** | | | | |

time interval between the arrival of goods on their docks and the entry of the goods into the inventory system. For example, a firm may have a staging area where goods remain for an average time period while awaiting quality or quantity verification. Hence, planned order receipt may be during the planning period when the goods are needed, or they may need to be received earlier depending on time requirements. Order release is then determined by offsetting the planned order receipt by the supplier's lead time. Figure 1 is a representation of a DRP calculation (ignoring possible safety stock requirements).

*SEE ALSO:* Forecasting; Logistics and Transportation; Reverse Supply Chain Logistics; Supply Chain Management; Warehousing and Warehouse Management

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## DIVERSIFICATION STRATEGY

Diversification strategies are used to expand firms' operations by adding markets, products, services, or stages of production to the existing business. The purpose of diversification is to allow the company to enter lines of business that are different from current operations. When the new venture is strategically related to the existing lines of business, it is called concentric diversification. Conglomerate diversification occurs when there is no common thread of strategic fit or relationship between the new and old lines of business; the new and old businesses are unrelated.

### DIVERSIFICATION IN THE CONTEXT OF GROWTH STRATEGIES

Diversification is a form of growth strategy. Growth strategies involve a significant increase in performance objectives (usually sales or market share) beyond past levels of performance. Many organizations pursue one or more types of growth strategies. One of the primary reasons is the view held by many investors and executives that "bigger is better." Growth in sales is often used as a measure of performance. Even if profits remain stable or decline, an increase in sales satisfies many people. The assumption is often made that if sales increase, profits will eventually follow.

Rewards for managers are usually greater when a firm is pursuing a growth strategy. Managers are often paid a commission based on sales. The higher the sales level, the larger the compensation received. Recognition and power also accrue to managers of growing companies. They are more frequently invited to speak to professional groups and are more often interviewed and written about by the press than are managers of companies with greater rates of return but slower rates of growth. Thus, growth companies also become better known and may be better able, to attract quality managers.

Growth may also improve the effectiveness of the organization. Larger companies have a number of advantages over smaller firms operating in more limited markets.

1. Large size or large market share can lead to economies of scale. Marketing or production synergies may result from more efficient use of sales calls, reduced travel time, reduced changeover time, and longer production runs.
2. Learning and experience curve effects may produce lower costs as the firm gains experience in producing and distributing its product or service. Experience and large size may also lead to improved layout, gains in labor efficiency, redesign of products or production processes, or larger and more qualified staff departments (e.g., marketing research or research and development).
3. Lower average unit costs may result from a firm's ability to spread administrative expenses and other overhead costs over a larger unit volume. The more capital intensive a business is, the more important its ability to spread costs across a large volume becomes.
4. Improved linkages with other stages of production can also result from large size. Better links with suppliers may be attained through large orders, which may produce lower costs (quantity discounts), improved delivery, or custom-made products that would be unaffordable for smaller operations. Links with distribution channels may lower costs by better location of warehouses, more efficient advertising, and shipping efficiencies. The size of the organization relative to its customers or suppliers influences its bargaining power and its ability to influence price and services provided.
5. Sharing of information between units of a large firm allows knowledge gained in one business unit to be applied to problems being experienced in another unit. Especially for companies relying heavily on technology, the reduction of R&D costs and the time needed to develop new technology may give larger firms an advantage over smaller, more specialized firms. The more similar the activities are among units, the easier the transfer of information becomes.
6. Taking advantage of geographic differences is possible for large firms. Especially for multinational firms, differences in wage rates, taxes, energy costs, shipping and freight charges, and trade restrictions influence the costs of business. A large firm can sometimes lower its cost of business by placing multiple plants in locations providing the lowest cost. Smaller firms with only one location must operate within the strengths and weaknesses of its single location.

## CONCENTRIC DIVERSIFICATION

Concentric diversification occurs when a firm adds related products or markets. The goal of such diversification is to achieve strategic fit. Strategic fit allows an organization to achieve synergy. In essence, synergy is the ability of two or more parts of an organization to achieve greater total effectiveness together than would be experienced if the efforts of the independent parts were summed. Synergy may be achieved by combining firms with complementary marketing, financial, operating, or management efforts. Breweries have been able to achieve marketing synergy through national advertising and distribution. By combining a number of regional breweries into a national network, beer producers have been able to produce and sell more beer than had independent regional breweries.

Financial synergy may be obtained by combining a firm with strong financial resources but limited growth opportunities with a company having great market potential but weak financial resources. For example, debt-ridden companies may seek to acquire firms that are relatively debt-free to increase the leveraged firm's borrowing capacity. Similarly, firms sometimes attempt to stabilize earnings by diversifying into businesses with different seasonal or cyclical sales patterns.

Strategic fit in operations could result in synergy by the combination of operating units to improve overall efficiency. Combining two units so that duplicate equipment or research and development are eliminated would improve overall efficiency. Quantity discounts through combined ordering would be another possible way to achieve operating synergy. Yet another way to improve efficiency is to diversify into an area that can use by-products from existing operations. For example, breweries have been able to convert grain, a by-product of the fermentation process, into feed for livestock.

Management synergy can be achieved when management experience and expertise is applied to different situations. Perhaps a manager's experience in working with unions in one company could be applied to labor management problems in another company. Caution must be exercised, however, in assuming that management experience is universally transferable. Situations that appear similar may require significantly different management strategies. Personality clashes and other situational differences may make management synergy difficult to achieve. Although managerial

skills and experience can be transferred, individual managers may not be able to make the transfer effectively.

## CONGLOMERATE DIVERSIFICATION

Conglomerate diversification occurs when a firm diversifies into areas that are unrelated to its current line of business. Synergy may result through the application of management expertise or financial resources, but the primary purpose of conglomerate diversification is improved profitability of the acquiring firm. Little, if any, concern is given to achieving marketing or production synergy with conglomerate diversification.

One of the most common reasons for pursuing a conglomerate growth strategy is that opportunities in a firm's current line of business are limited. Finding an attractive investment opportunity requires the firm to consider alternatives in other types of business. Philip Morris's acquisition of Miller Brewing was a conglomerate move. Products, markets, and production technologies of the brewery were quite different from those required to produce cigarettes.

Firms may also pursue a conglomerate diversification strategy as a means of increasing the firm's growth rate. As discussed earlier, growth in sales may make the company more attractive to investors. Growth may also increase the power and prestige of the firm's executives. Conglomerate growth may be effective if the new area has growth opportunities greater than those available in the existing line of business.

Probably the biggest disadvantage of a conglomerate diversification strategy is the increase in administrative problems associated with operating unrelated businesses. Managers from different divisions may have different backgrounds and may be unable to work together effectively. Competition between strategic business units for resources may entail shifting resources away from one division to another. Such a move may create rivalry and administrative problems between the units.

Caution must also be exercised in entering businesses with seemingly promising opportunities, especially if the management team lacks experience or skill in the new line of business. Without some knowledge of the new industry, a firm may be unable to accurately evaluate the industry's potential. Even if the new business is initially successful, problems will eventually occur. Executives from the conglomerate will have to become involved in the operations of the new enterprise at some point. Without adequate experience or skills (Management Synergy) the new business may become a poor performer.

Without some form of strategic fit, the combined performance of the individual units will probably not exceed the performance of the units operating independently. In fact, combined performance may deteriorate because of controls placed on the individual units by the parent conglomerate. Decision-making may become slower due to longer review periods and complicated reporting systems.

## DIVERSIFICATION: GROW OR BUY?

Diversification efforts may be either internal or external. Internal diversification occurs when a firm enters a different, but usually related, line of business by developing the new line of business itself. Internal diversification frequently involves expanding a firm's product or market base. External diversification may achieve the same result; however, the company enters a new area of business by purchasing another company or business unit. Mergers and acquisitions are common forms of external diversification.

**INTERNAL DIVERSIFICATION.** One form of internal diversification is to market existing products in new markets. A firm may elect to broaden its geographic base to include new customers, either within its home country or in international markets. A business could also pursue an internal diversification strategy by finding new users for its current product. For example, Arm & Hammer marketed its baking soda as a refrigerator deodorizer. Finally, firms may attempt to change markets by increasing or decreasing the price of products to make them appeal to consumers of different income levels.

Another form of internal diversification is to market new products in existing markets. Generally this strategy involves using existing channels of distribution to market new products. Retailers often change product lines to include new items that appear to have good market potential. Johnson & Johnson added a line of baby toys to its existing line of items for infants. Packaged-food firms have added salt-free or low-calorie options to existing product lines.

It is also possible to have conglomerate growth through internal diversification. This strategy would entail marketing new and unrelated products to new markets. This strategy is the least used among the internal diversification strategies, as it is the most risky. It requires the company to enter a new market where it is not established. The firm is also developing and introducing a new product. Research and development costs, as well as advertising costs, will likely be higher than if existing products were marketed. In effect, the investment and the probability of failure are much greater when both the product and market are new.

**EXTERNAL DIVERSIFICATION.** External diversification occurs when a firm looks outside of its current operations and buys access to new products or markets. Mergers are one common form of external diversification. Mergers occur when two or more firms combine operations to form one corporation, perhaps with a new name. These firms are usually of similar size. One goal of a merger is to achieve management synergy by creating a stronger management team. This can be achieved in a merger by combining the management teams from the merged firms.

Acquisitions, a second form of external growth, occur when the purchased corporation loses its identity. The acquiring company absorbs it. The acquired company and its assets may be absorbed into an existing business unit or remain intact as an independent subsidiary within the parent company. Acquisitions usually occur when a larger firm purchases a smaller company. Acquisitions are called friendly if the firm being purchased is receptive to the acquisition. (Mergers are usually "friendly.") Unfriendly mergers or hostile takeovers occur when the management of the firm targeted for acquisition resists being purchased.

## DIVERSIFICATION: VERTICAL OR HORIZONTAL?

Diversification strategies can also be classified by the direction of the diversification. Vertical integration occurs when firms undertake operations at different stages of production. Involvement in the different stages of production can be developed inside the company (internal diversification) or by acquiring another firm (external diversification). Horizontal integration or diversification involves the firm moving into operations at the same stage of production. Vertical integration is usually related to existing operations and would be considered concentric diversification. Horizontal integration can be either a concentric or a conglomerate form of diversification.

**VERTICAL INTEGRATION.** The steps that a product goes through in being transformed from raw materials to a finished product in the possession of the customer constitute the various stages of production. When a firm diversifies closer to the sources of raw materials in the stages of production, it is following a backward vertical integration strategy. *Avon's* primary line of business has been the selling of cosmetics door-to-door. *Avon* pursued a backward form of vertical integration by entering into the production of some of its cosmetics. Forward diversification occurs when firms move closer to the consumer in terms of the production stages. Levi Strauss & Co., traditionally a manufacturer of clothing, has diversified forward by opening retail stores to market its textile products rather than producing them and selling them to another firm to retail.

Backward integration allows the diversifying firm to exercise more control over the quality of the supplies being purchased. Backward integration also may be undertaken to provide a more dependable source of needed raw materials. Forward integration allows a manufacturing company to assure itself of an outlet for its products. Forward integration also allows a firm more control over how its products are sold and serviced. Furthermore, a company may be better able to differentiate its products from those of its competitors by forward integration. By opening its own retail outlets, a firm is often better able to control and train the personnel selling and servicing its equipment.

Since servicing is an important part of many products, having an excellent service department may provide an integrated firm a competitive advantage over firms that are strictly manufacturers.

Some firms employ vertical integration strategies to eliminate the "profits of the middleman." Firms are sometimes able to efficiently execute the tasks being performed by the middleman (wholesalers, retailers) and receive additional profits. However, middlemen receive their income by being competent at providing a service. Unless a firm is equally efficient in providing that service, the firm will have a smaller profit margin than the middleman. If a firm is too inefficient, customers may refuse to work with the firm, resulting in lost sales.

Vertical integration strategies have one major disadvantage. A vertically integrated firm places "all of its eggs in one basket." If demand for the product falls, essential supplies are not available, or a substitute product displaces the product in the marketplace, the earnings of the entire organization may suffer.

**HORIZONTAL DIVERSIFICATION.** Horizontal integration occurs when a firm enters a new business (either related or unrelated) at the same stage of production as its current operations. For example, Avon's move to market jewelry through its door-to-door sales force involved marketing new products through existing channels of distribution. An alternative form of horizontal integration that Avon has also undertaken is selling its products by mail order (e.g., clothing, plastic products) and through retail stores (e.g., Tiffany's). In both cases, Avon is still at the retail stage of the production process.

## DIVERSIFICATION STRATEGY AND MANAGEMENT TEAMS

As documented in a study by Marlin, Lamont, and Geiger, ensuring a firm's diversification strategy is well matched to the strengths of its top management

team members factored into the success of that strategy. For example, the success of a merger may depend not only on how integrated the joining firms become, but also on how well suited top executives are to manage that effort. The study also suggests that different diversification strategies (concentric vs. conglomerate) require different skills on the part of a company's top managers, and that the factors should be taken into consideration before firms are joined.

There are many reasons for pursuing a diversification strategy, but most pertain to management's desire for the organization to grow. Companies must decide whether they want to diversify by going into related or unrelated businesses. They must then decide whether they want to expand by developing the new business or by buying an ongoing business. Finally, management must decide at what stage in the production process they wish to diversify.

*SEE ALSO:* Strategic Planning Failure; Strategy Formulation; Strategy Implementation; Strategy in the Global Environment

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## DIVERSITY

The advent of equal employment opportunity (EEO) laws and affirmative action programs created new employment opportunities for members of protected groups that had previously been victimized by employment discrimination. The demographic mix within the twenty-first century workplace has consequently become much more diverse because many workers now entering the workforce are neither white, male, nor English speaking. People of color continue to increase their shares of the labor force. The rates of growth for these groups are projected to be faster than the rate for whites. Whereas the White non-Hispanics are projected to continue to decline as a percentage of the labor force, Hispanics are predicted to be the second largest group in 2025, accounting for 17 percent of the total labor force. Furthermore, as of 2000, Hispanics have a larger share of the market than African Americans, 13 percent versus 12.7 percent. The share of African Americans in the labor force is expected to increase by only 1.8 percent during the same time period. Asians and other people of color would account for approximately 8 percent of the labor force in 2025. Hispanics and Asians, therefore, will continue to be the two fastest growing groups.

The workforce is also becoming older and is experiencing a dramatic increase in the number of dual-income families (many of whom have young children), single-parent families, and families facing the demands of elder care. The projected labor market will continue to be significantly impacted by the aging of the baby-boom generation.

In the past, organizations ignored the impact that diversity had on the attitudes and behavior of employees. However, 25 years of political, social, and legal change brought new groups of employees into the workplace. At first, organizations attempted to handle these new groups through assimilation. People were expected to fit in. Equal treatment at the workplace meant the same treatment for each employee; individual differences were ignored. Consequently, assimilation often resulted in pressure to conform, exclusion and isolation, and reinforcement of the dominant group values. The problem became compounded as the number of diverse groups within the organization increased and the number of white males declined.

The failure to deal effectively with the diversity issue can hinder competitive advantage. For instance, firms choosing to do business as usual have been plagued with a high turnover among nontraditional employees, low morale within the organization, underutilization of employee skills, numerous intergroup conflicts, low productivity, and an inability to attract new workers. On the other hand, if diversity is dealt with effectively, competitive advantage can be enhanced. For instance, companies that value diversity can attract a larger and better pool of applicants than companies which limit themselves to a traditional workforce.

Accommodating the needs of the diverse workforce is more important to organizations now than ever

before. When properly managed, such cultural diversity can represent a key strategic advantage. Diversity in age, gender, race, and viewpoint can offer organizations a number of benefits including additional knowledge, creative ideas and insights to aid in problem solving, enhanced product positioning, better development of strategic plans and objectives, and fresh opinions. These diverse workers can bring original ideas and approaches to the workplace that can help a firm target its products and services to a marketplace that is becoming more and more diverse. This adds economic importance to the issue of diversity since the combined African-American, Hispanic-American and Asian-American buying power is more than $750 billion dollars.

## MINORITIES IN THE WORKPLACE

Although minorities have been entering the workforce in record numbers, their quests to reach the top of the corporate ladder have been thwarted. Many have topped out at entry- or mid-level management positions. Consider the following statistics:

- African Americans hold less than 1 percent of the senior-level corporate positions in America's 1000 largest companies despite EEO and affirmative action programs.
- Only 1.97 percent of Fortune 1000 board seats are held by Hispanics and Hispanic women hold only three tenths of all Fortune 1000 board seats. That is just 34 out of 10,314 seats. In addition, only seven Hispanic women serve as executive officers at Fortune 1000 companies.
- An examination of the Fortune 1000 companies reveals that only 3 percent have an African American on their Board of Directors.

Minorities have failed to reach the highest levels of management partly because many have only recently entered the managerial ranks; it takes time to climb the corporate ladder. However, this explanation does not account for the magnitude of the problem. For years minorities have faced invisible, subtle, yet very real institutional barriers to promotions into higher level executive positions. The belief that minority groups reach organizational plateaus consisting of artificial barriers that derail them from senior management opportunities has been alternately termed "the glass ceiling," or "the brick wall." These barriers found in the structure of many organizations have often stymied the advancement of these select employee groups.

How can the glass ceilings be cracked or the brick walls broken down? Effective diversity training that helps decision-makers overcome their biases would certainly help. But diversity training, by itself, is not enough, and diversity management must not be confused with affirmative action. The Society for Human Resource Management recommends the following components for a successful diversity initiative:

1. **Get executive commitment.** Enlisting the visible support and commitment of your organization's CEO is fundamental to a successful diversity initiative.
2. **Articulate the desired outcomes.** Be explicit about how support and commitment are to be shown and from whom it is expected.
3. **Assess the climate, needs and issues at your organization.** The use of focus groups can help clarify the obstacles. It will prove helpful to determine where your organization is currently on the diversity continuum before determining what interventions need to be taken.
4. **Create and maintain open channels of communication with employees at the launch of your diversity initiative and throughout the process.** Communication is crucial to the success of your diversity plan and should occur not only at the beginning of a diversity initiative, but also throughout the process.
5. **Consider forming a diversity taskforce to widen your support base.** This group can help analyze assessment data and make recommendations to top management.
6. **Develop a mechanism for dealing with systemic changes and procedural problems.** Once identified, obstacles and problems must be addressed. For example, your company may be committed to hiring persons outside of the dominant culture, but has difficulty promoting those same persons once they are with the organization.
7. **Design relevant, interactive applicable training.** The purpose of good training is to not just increase awareness and understanding about diversity, but to also develop concrete skills that employees can use to deal with workplace diversity, its implications and its effects.
8. **Evaluate and measure each component of your diversity initiative (training, taskforce, mentoring initiative, employee networks, etc.).** Set measurable criteria and determine what you would like to accomplish and how you will gather data.
9. **Ensure integration and accountability.** Integrate the concepts, skills and results of

your diversity efforts into the fabric of the organization and hold management accountable for encouraging diversity throughout the organization.

Dealing with diversity is a continuing process that enhances an organization's ability to adapt and capitalize on today's increasingly complex world and global marketplace. A well-managed diverse workforce can give your company the competitive advantage necessary to compete in a global economy.

*SEE ALSO:* Employment Law and Compliance; International Cultural Differences; Mentoring; Organizational Culture; Work-Life Balance

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## DIVESTMENT

Divestment is a form of retrenchment strategy used by businesses when they downsize the scope of their business activities. Divestment usually involves eliminating a portion of a business. Firms may elect to sell, close, or spin-off a strategic business unit, major operating division, or product line. This move often is the final decision to eliminate unrelated, unprofitable, or unmanageable operations.

Divestment is commonly the consequence of a growth strategy. Much of the corporate downsizing of the 1990s has been the result of acquisitions and takeovers that were the rage in the 1970s and early 80s. Firms often acquired other businesses with operations in areas with which the acquiring firm had little experience. After trying for a number of years to integrate the new activities into the existing organization, many firms have elected to divest themselves of portions of the business in order to concentrate on those activities in which they had a competitive advantage.

### REASONS TO DIVEST

In most cases it is not immediately obvious that a unit should be divested. Many times management will attempt to increase investment as a means of giving the unit an opportunity to turn its performance around. Portfolio models such as the Boston Consulting Group (BCG) Model or General Electric's Business Screen can be used to identify operations in need of divestment. For example, products or business operations identified as "dogs" in the BCG Model are prime candidates for divestment.

Decisions to divest may be made for a number of reasons:

**MARKET SHARE TOO SMALL.** Firms may divest when their market share is too small for them to be competitive or when the market is too small to provide the expected rates of return.

**AVAILABILITY OF BETTER ALTERNATIVES.** Firms may also decide to divest because they see better investment opportunities. Organizations have limited resources. They are often able to divert resources from a marginally profitable line of business to one where the same resources can be used to achieve a greater rate of return.

**NEED FOR INCREASED INVESTMENT.** Firms sometimes reach a point where continuing to maintain an operation is going to require large investments in equipment, advertising, research and development, and so forth to remain viable. Rather than invest the monetary and management resources, firms may elect to divest that portion of the business.

**LACK OF STRATEGIC FIT.** A common reason for divesting is that the acquired business is not consistent with the image and strategies of the firm. This can be the result of acquiring a diversified business. It may also result from decisions to restructure and refocus the existing business.

**LEGAL PRESSURES TO DIVEST.** Firms may be forced to divest operations to avoid penalties for restraint of trade. Service Corporation Inc., a large funeral home chain acquired so many of its competitors in some areas that it created a regional monopoly. The Federal Trade Commission required the firm to divest some of its operations to avoid charges of restraint of trade.

## IMPLEMENTATION OF DIVESTMENT STRATEGIES

Firms may pursue a divestment strategy by spinning off a portion of the business and allowing it to operate as an independent business entity. Firms may also divest by selling a portion of the business to another organization. RJR Nabisco used both of these forms of divestment. In 1985 Nabisco Brands was bought by R.J. Reynolds, the manufacturer of Winston, Camel, and many other cigarette brands. Fueled in part by fears of legal liability resulting from tobacco lawsuits and by complaints from investors that the tobacco side of RJR Nabisco was dragging the food business down, in early 1999 the decision was made to spin-off the domestic tobacco operations into a separate company. Later in 1999 the decision was made to sell the overseas tobacco business to Japan Tobacco.

Another way to implement a divestment decision is to simply close a portion of the firm's operations. Faced with a decline in its market share of almost half in the 14 to 19 male age group and no introduction of a successful new product in years, and rising manufacturing costs, Levi Strauss has found it necessary to divest some of its operations. Since 1997 the company has announced plans to shut twenty-nine factories in North America and Europe and to eliminate 16,310 jobs. Selling many of the plants probably was not feasible as many other clothing manufacturers are also closing plants and moving operations overseas, depressing the price for clothing manufacturing facilities. Besides, the most likely buyers for the Levi's plants would be competitors and Levi Strauss probably would not want them to have the added capacity.

In 2004 Teleflex, a U.S. $2 billion industrial product manufacturer implemented a divestment and acquisition strategy to remove underperforming units while acquiring companies in markets where it intended to expand its business. Although a business may be identified as a target for divestment, the implementation of divestment is not always easy. First a buyer must be found. This may be difficult for a failing business unit. Once a buyer is found, then price must be negotiated. Many divestments are blocked by management's expectations for the operation. Firms may expect demand for the product to pick up. Management may also see the poor performance as a temporary setback that can be overcome with time and patience. Decisions to divest a business may be seen as an admission of failure on the part of management and may lead to escalating commitment to the struggling business as a way of protecting management's ego and public image. Robert Haas, president and CEO at Levi Strauss & Co., has certainly received bad publicity and has had his leadership abilities and judgment questioned as a result of his decision to close company plants and eliminate over 16,000 jobs.

Divestment is not usually the first choice of strategy for a business. However, as product demand changes and firms alter their strategies, there will almost always be some portion of the business that is not performing to management's expectations. Such an operation is a prime target for divestment and may well leave the company in a stronger competitive position if it is divested.

*SEE ALSO:* Downsizing and Rightsizing; Strategic Planning Failure; Strategy Implementation

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# DOMESTIC MANAGEMENT SOCIETIES AND ASSOCIATIONS

Management societies and associations exist to promote greater professionalism within the field and provide educational opportunities for their members. Many societies and associations exist within the field of management. Some have members primarily from academia; others have members who are primarily practitioners; while still others have both. Although almost all associations within the field of management have some international members, the focus of the following paragraphs is on those societies and associations whose membership is predominantly in the United States.

The management associations discussed in this article all have similar organization structures and activities:

- All sponsor a variety of useful professional services available to their members.
- Most have local chapters that are affiliated with the national organization.

- Most have at least one and sometimes several conferences each year and sponsor publications designed to disseminate management research findings or to communicate helpful information to management practitioners.
- Some offer professional certification programs to allow members to demonstrate their competence within their area of specialty.

## ACADEMY OF MANAGEMENT

The Academy of Management (AOM) is the preeminent professional organization for those involved or interested in management research and education in the United States. It was founded in 1936, and its membership consisted of about 12,000 individuals as of 2004. Most of its members are college professors teaching within the field of management or related disciplines. Most academy members have Ph.D.s in management or related disciplines. The academy also has some practitioner members. Although the academy has members from around the world, the overwhelming majority of its membership is in the United States.

AOM sponsors an annual conference each August. At this meeting, educational and professional development programs are held and scholarly research papers are presented and discussed. Other activities at the annual meeting include meetings of various divisions and interest groups and a job placement service that allows universities to recruit for qualified applicants to fill open faculty positions in management and related fields.

AOM publishes scholarly journals and a newsletter. The *Academy of Management Journal (AMJ)* features empirical papers, and the *Academy of Management Review (AMR)* features theoretical papers. The *Academy of Management Executive (AME)* publishes applied articles related to management practice and has a substantial readership among practitioners. There is also the *Academy of Management Learning and Education (AMLE).*

AOM has a variety of divisions and interest groups that allow members with common interests to interact more closely. Some of these divisions include Business Policy & Strategy, Human Resource Management, Organizational Behavior, Operations Management, Social Issues in Management, Entrepreneurship, and Management History.

Within AOM, there are several associated organizations, including the Southern Management Association, the Eastern Academy of Management, the Southwest Academy of Management, the Midwest Academy of Management, and the Western Academy of Management. Each of these regional associations holds annual meetings of its own, with activities that are similar to those that take place at the national meeting of the academy. Many management scholars also hold memberships in one or more of these regional associations.

AOM has a significant presence online (http://www.aomonline.org). The site has information of interest to management scholars and researchers, news about upcoming conferences, and links to related divisions and groups.

## AMERICAN MANAGEMENT ASSOCIATION

The American Management Association (AMA) is a large, nonprofit educational association that has as its goal the development of organizational effectiveness. AMA has programs related to many areas of management practice, including general and administrative services, strategic management, human resources, information systems, manufacturing, purchasing, research and development, and sales and marketing. Founded in 1923, AMA has about 80,000 members. Membership consists mainly of management practitioners based in the United States, although it does have a significant membership around the world.

AMA publishes about 80 business-related books each year. It also publishes several periodicals related to management, including *Management Review, The Take-Charge Assistant, Organizational Dynamics,* and *HR Focus.*

The association holds an annual conference and sponsors numerous seminars, workshops, and forums on various management-related topics.

AMA's web site (http://www.amanet.org) provides details about its programs, conferences, and seminars, as well as other useful information relevant to the practicing manager.

## SOCIETY FOR HUMAN RESOURCE MANAGEMENT

The Society for Human Resource Management (SHRM), founded in 1948, is the largest professional association in its field. Its approximately 63,000 members are largely in the United States, and also belong to local professional chapters or college and university student chapters.

SHRM has several professional publications, most of which are free with membership in the organization. Its premiere publication is the monthly *HR Magazine. HR News, Workplace Visions,* and *Mosaics* are primarily of interest to practitioners. *HRM Journal* features academic research of interest to scholars in the field.

SHRM sponsors professional development and certification programs. Professional development activities include seminars and certificate programs, portfolio subscriptions, and certification preparation learning modules. A certification program is administered through the Human Resource Certification Institute (HRCI). Certification is available at two levels: Professional in Human Resources (PHR) and Senior Professional in Human Resources (SPHR). Certification requires several years of experience in an exempt HR position and the successful completion of a certification examination, which is offered twice a year.

SHRM funds human resources management academic research through its Foundation. It also conducts an annual HR salary survey.

The society holds an annual conference and exposition, an employment law and legislative conference, a leadership conference, and a diversity conference.

SHRM's web site (http://www.shrm.org) contains a wide variety of resources for the HR professional, including an information center, online publications, and a placement area. Although some of the internet services are available to the public, most are restricted to SHRM members.

## APICS: THE ASSOCIATION FOR OPERATIONS MANAGEMENT

APICS: The Association for Operations Management (formerly Association for Production and Inventory Control) is a professional organization for those involved or interested in operations management, and production and inventory management. It provides professional certifications, educational programs, and publications. Founded in 1957, APICS has practitioner, academic, and student members. There are approximately 60,000 members worldwide, though concentrated in the United States.

APICS offers member discounts on educational materials, programs, and certification exam and review material. The organization also offers numerous national workshops and in-house training programs. Publications include *APICS—The Performance Advantage* and the *Production and Inventory Management Journal.*

APICS has two certification programs for professionals in the field: Certified in Production and Inventory Management (CPIM) and Certified in Integrated Resource Management (CIRM). CPIM certification was developed in 1973 to provide a means for individuals to assess their knowledge of production and inventory management relative to a common core of knowledge. CIRM certification was developed in 1991 and is designed to assess cross-functional knowledge of interrelated functions within an organization.

APICS holds an annual conference that allows members to learn about the latest management and manufacturing techniques. It also sponsors various research activities, including an undergraduate and graduate paper competition through its Educational and Research Foundation.

The APICS web site (http://www.apics.org) contains information about its services and the field.

## WORLD AT WORK

Founded in 1955, WorldatWork (formerly the American Compensation Association) is a professional organization for those involved or interested in the management of employee compensation and benefits policies and procedures. WorldatWork provides information, training, research support, and networking opportunities to its 25,000 members. Specific benefits of membership include discounts on WorldatWork educational and training programs, career placement and networking opportunities, and updates in the field through various publications.

WorldatWork offers various educational and professional training programs. Seminars provide training in all areas of compensation and benefits management. In-house training programs allow organizations to sponsor training for their employees on-site.

WorldatWork sponsors a certification program that allows members to increase their credibility as a compensation and benefits management professional. Certification is available along two tracks: Certified Compensation Professional (CCP) and Certified Benefits Professional (CBP).

WorldatWork holds an annual conference and sponsors various research activities at leading U.S. universities. It publishes several journals and newsletters, including *Workspan* and *WorldatWork Journal.*

WorldatWork also attempts to increase linkages between practitioners and academia through its Academic Partnership Network. This concept is designed to foster increased communication between practitioners and academics.

WorldatWork's web site (http://www.worldatwork.org) includes information resources for the compensation and benefits professional.

## INSTITUTE FOR SUPPLY MANAGEMENT

The Institute for Supply Management (ISM) is a professional association designed to advance the purchasing and supply management profession. Founded in 1915, it has approximately 45,000 members, mostly in the United States. To be eligible for membership, a person must be involved in the purchasing or materials process, be employed by an affiliated association,

or be a full-time professor or administrator at a college or university whose academic responsibility includes purchasing or material management courses.

ISM offers a variety of educational and development programs and products. Conferences, seminars, and other educational activities allow purchasing and material managers to expand their professional skills.

ISM publishes *Inside Supply Management, International Journal of Purchasing and Materials Management,* and *Manufacturing ISM Report on Business,* a well-respected purchasing survey and indicator of economic trends.

ISM sponsors two certification programs: the Certified Purchasing Manager, which allows purchasing or materials management professionals to demonstrate their mastery of the requirements of the field; and the Accredited Purchasing Practitioner, designed primarily for entry-level buyers engaged in the operational side of purchasing and materials management.

ISM provides information about its conferences, seminars, professional forums, products, and other information of interest to the purchasing and materials management professional on its website at (http://www.ism.ws).

*SEE ALSO:* International Management Societies and Associations; Management and Executive Development

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## DOWNSIZING AND RIGHTSIZING

Downsizing refers to the permanent reduction of a company's workforce and is generally associated with corporate reorganization, or creating a "leaner, meaner" company. For example, the database developer Oracle Corporation reduced its number of employees by 5,000 after acquiring rival PeopleSoft. Downsizing is certainly not limited to the U.S.; Jamaica Air cut 15 percent of its workforce in an effort to trim expenses and anticipated revenue shortfalls.

Downsizings such as these are also commonly called reorganizing, reengineering, restructuring, or rightsizing. Regardless of the label applied, however, downsizing essentially refers to layoffs that may or may not be accompanied by systematic restructuring programs, such as staff reductions, departmental consolidations, plant or office closings, or other forms of reducing payroll expenses. Corporate downsizing results from both poor economic conditions and company decisions to eliminate jobs in order to cut costs and maintain or achieve specific levels of profitability. Companies may lay off a percentage of their employees in response to these changes: a slowed economy, merging with or acquiring other companies, the cutting of product or service lines, competitors grabbing a higher proportion of market share, distributors forcing price concessions from suppliers, or a multitude of other events that have a negative impact on specific organizations or entire industries. In addition, downsizing may stem from restructuring efforts to maximize efficiency, to cut corporate bureaucracy and hierarchy and thereby reduce costs, to focus on core business functions and outsource non-core functions, and to use part-time and temporary workers to complete tasks previously performed by full-time workers in order to trim payroll costs.

The following sections discuss trends in downsizing, the growth of downsizing, downsizing and restructuring, criticisms of downsizing, support for downsizing, and downsizing and management.

### TRENDS IN DOWNSIZING

As a major trend among U.S. businesses, downsizing began in the 1980s and continued through the 1990s largely unabated and even growing. During this time, many of the country's largest corporations participated in the trend, including General Motors, AT&T, Delta Airlines, Eastman Kodak, IBM, and Sears, Roebuck and Company. In the twenty-first century, downsizing continued after a sharp decline in the stock market early in the century and followed by continued pressure on corporate earnings in the aftermath of the September 11, 2002, terrorist attacks. Downsizing affects most sectors of the labor market, including retail, industrial, managerial, and office jobs, impacting workers in a wide range of income levels. Table 1 compares the number of temporarily downsized workers with the number of permanently downsized workers.

While layoffs are a customary measure for companies to help compensate for the effects of recessions, downsizing also occurs during periods of economic prosperity, even when companies themselves are doing well. Consequently, downsizing is a controversial corporate practice that receives support and even praise from executives, shareholders, and some economists, and criticism from employees, unions, and community activists. Reports of executive salaries growing in the face of downsizing and stagnant wages for retained employees only fan the flames of this criticism. In contrast, announcements of downsizing are well received in the stock markets. It is not uncommon for a company's stock value to rise following a downsizing announcement.

**Table 1**
**Number of U.S. Unemployed Workers by Month**

| Type of Downsizing | October 2004 | November 2004 | December 2004 | January 2005 | February 2005 |
|---|---|---|---|---|---|
| Temporary downsizing | 947,000 | 941,000 | 965,000 | 966,000 | 965,000 |
| Permanent downsizing | 3,127,000 | 3,124,000 | 3,144,000 | 3,082,000 | 3,015,000 |

Adapted from: U.S. Department of Labor, Bureau of Labor Statistics. 2005. Unemployed Persons by Reason of Unemployment. Employment Situation Summary

However, economists remain optimistic about downsizing and the effects of downsizing on the economy when the rate of overall job growth outpaces the rate of job elimination. A trend toward outsourcing jobs overseas to countries with lower labor costs is a form of downsizing that affects some U.S. employees. These jobs are not actually eliminated, but instead moved out of reach of the employees who lose their jobs to outsourcing. Some economists, however, suggest that the overall net effect of such outsourced jobs will actually be an increase in U.S. jobs as resulting corporate operating efficiencies allow for more employment of higher-tier (and thus higher-wage) positions. Regardless of whether downsizing is good or bad for the national economy, companies continue to downsize and the trend shows few signs of slowing down. For some sectors, this trend is projected to be particularly prevalent through 2012, as shown in Table 2.

**Table 2**
**Projected Job Decline in Selected Occupations, 2002-2012**

| Occupation | Projected Decline |
|---|---|
| Chemical plant and system operators | -12% |
| Travel agents | -14% |
| Brokerage clerks | -15% |
| Fisheries workers | -27% |
| Textile workers | -34% |
| Word processors and typists | -39% |
| Telephone operators | -56% |

Adapted from: U.S. Department of Labor, Bureau of Labor Statistics. 2005. Occupations with the Largest Job Decline, 2002-2012.

## THE GROWTH OF DOWNSIZING

The corporate downsizing trend grew out of the economic conditions of the late 1970s, when direct international competition began to increase. The major industries affected by this stiffer competition included the automotive, electronics, machine tool, and steel industries. In contrast to their major competitors—Japanese manufacturers—U.S. companies had significantly higher costs. For example, U.S. automobile manufacturers had approximately a $1,000 cost disadvantage for their cars compared to similar classes of Japanese cars. Only a small percentage of this cost difference could be attributed to labor costs, however, but labor costs were among the first to be cut despite other costs associated with the general structure of the auto companies and their oversupply of middle managers and engineers. Auto workers were among the first to be laid off during the initial wave of downsizing. Other U.S. manufacturing industries faced similar competitive problems during this period, as did some U.S. technology industries. Companies in these industries, like those in the auto industry, suffered from higher per-unit costs and greater overhead than their Japanese counterparts due to lower labor productivity and a glut of white-collar workers in many U.S. companies.

To remedy these problems, U.S. companies implemented a couple of key changes: they formed partnerships with Japanese companies to learn the methods behind their cost efficiencies and they strove to reduce costs and expedite decision-making by getting rid of unnecessary layers of bureaucracy and management. Nevertheless, some companies began simply to cut their workforce without determining whether or not it was necessary and without any kind of accompanying strategy. In essence, they downsized because they lacked new products that would have stimulated growth and because their existing product markets were decreasing.

## DOWNSIZING AND RESTRUCTURING

Downsizing generally accompanies some kind of restructuring and reorganizing, either as part of the downsizing plan or as a consequence of downsizing. Since companies frequently lose a significant amount of employees when downsizing, they usually must reallocate tasks and responsibilities. In essence, restructuring efforts attempt to increase the amount of work output relative to the amount of work input. Consequently, downsizing often accompanies corporate calls for concentration on "core capabilities" or "core businesses," which refers to the interest in focusing on the primary revenue-generating aspects of

a business. The jobs and responsibilities that are not considered part of the primary revenue-generating functions are the ones that are frequently downsized. These jobs might then be outsourced or handled by outside consultants and workers on a contract basis.

Eliminating non-core aspects of a business may also include the reduction of bureaucracy and the number of corporate layers. Since dense bureaucracy frequently causes delays in communication and decision-making, the reduction of bureaucracy may help bring about a more efficient and responsive corporate structure that can implement new ideas more quickly.

Besides laying off workers, restructuring efforts may involve closing plants, selling non-core operations, acquiring or merging with related companies, and overhauling the internal structure of a company. The seminal work on restructuring or reengineering, *Reinventing the Corporation,* by Michael Hammer and James Champy, characterizes the process as the "fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service, and speed." While discussion of reengineering is common and reengineering is often associated with downsizing, Hammer and Champy argue that reengineering efforts are not always as profound. Hence, these efforts frequently have mixed results.

Downsizing and reengineering programs may result from the implementation of new, labor-saving technology. For example, the introduction of the personal computer into the office has facilitated instantaneous communication and has thus reduced the need for office support positions, such as secretaries.

## CRITICISM OF DOWNSIZING

While companies frequently implement downsizing plans to increase profitability and productivity, downsizing does not always yield these results. Although critics of downsizing do not rule out the benefits in all cases, they contend that downsizing is overapplied and often used as a quick fix without sufficient planning to bring about long-term benefits. Moreover, downsizing can lead to additional problems, such as poor customer service, low employee morale, and bad employee attitudes. Laying workers off to improve competitiveness often fails to produce the intended results because downsizing can lead to the following unforeseen problems and difficulties:

- The loss of highly-skilled and reliable workers and the added expense of finding new workers.
- An increase in overtime wages.
- A decline in customer service because workers feel they lack job security after layoffs.
- Employee attitudes that may change for the worse, possibly leading to tardiness, absenteeism, and reduced productivity.
- An increase in the number of lawsuits and disability claims, which tends to occur after downsizing episodes.
- Restructuring programs sometimes take years to bear fruit because of ensuing employee confusion and the amount of time it takes for employees to adjust to their new roles and responsibilities.

Some studies have indicated that the economic advantages of downsizing have failed to come about in many cases, and that downsizing may have had a negative impact on company competitiveness and profitability in some cases.

Downsizing has repercussions that extend beyond the companies and their employees. For example, governments must sometimes enact programs to help displaced workers obtain training and receive job placement assistance. Labor groups have reacted to the frequency and magnitude of downsizing, and unions have taken tougher stances in negotiations because of it.

Instead of laying employees off, critics recommend that companies eliminate jobs only as a last resort; not as a quick fix when profits fail to meet quarterly projections. Suggested alternatives to downsizing include early retirement packages and voluntary severance programs. Furthermore, some analysts suggest that companies can improve their efficiency, productivity, and competitiveness through quality initiatives such as Six Sigma, empowering employees through progressive human resource strategies that encourage employee loyalty and stability, and other such techniques.

## SUPPORT FOR DOWNSIZING

Advocates of downsizing counter critics' claims by arguing that, through downsizing, the United States has maintained its position as one of the world's leading economies. Economists point out that despite the downsizing that has become commonplace since the 1970s, overall U.S. standards of living, productivity, and corporate investment have grown at a healthy pace. They reason that without downsizing, companies would not remain profitable and hence would go bankrupt when there is fierce competition and slow growth. Therefore, some executives and economists see downsizing as a necessary albeit painful task, and one that ultimately saves the larger number of jobs that would be lost if a company went out business.

Advocates of downsizing also argue that job creation from technological advances offsets job declines

from downsizing. Hence, displaced workers are able find new jobs relatively easily, especially if those workers have skills that enhance the technological competence of prospective employers. In other words, despite the admitted discomfort and difficulties that downsizing has on displaced workers, some workers are able to locate new jobs and companies are able to achieve greater efficiency, competitiveness, and profitability. Moreover, even though downsizing may not solve all of a company's competitive problems or bolster a company's profits indefinitely, downsizing can help reduce costs, which can lead to greater short-term profitability. In addition, advocates of downsizing contend that staff-reduction efforts help move workers from mature, moribund, and obsolete industries to emerging and growing industries, where they are needed. Economists argue that this process strengthens the economy and helps it grow. This process also enables companies with growing competitive advantages to maintain their positions in the market in the face of greater domestic and global competition, and it is the difficult but necessary result of the transition toward a global economy.

## DOWNSIZING AND MANAGEMENT

Downsizing poses the immediate managerial problem of dismissing a large number of employees in a dignified manner in order to help minimize the trauma associated with downsizing. Employees who are laid off tend to suffer from depression, anxiety, insomnia, high blood pressure, marital discord, and a host of other problems. Thus, when companies decide that downsizing is the best course of action, managers should do so in a way that does the least harm to employees and their families. This includes taking the time to allow dismissed employees to air their thoughts, instead of laying them off quickly and impersonally, and providing assistance in finding new jobs.

Because of the possible negative effects that occur after downsizing, managers may have to implement measures to counteract employee apathy, improve customer service, and restore employee trust. Analysts of downsized companies argue that managers should take steps immediately after workforce reductions to provide the remaining workers with the support and guidance they need. This involves providing employees with clear indications of what is expected of them and how they can meet increased productivity goals. Managers should confer with employees regularly to discuss performance and strategies for meeting the goals. In addition, managers should encourage employee initiative and communication and provide employees with rewards for excellent work. By promoting employee initiative and even employee involvement in decision-making, managers can help restore employee trust and commitment and help increase employee motivation.

The aftermath of downsizing also places greater demands on managers to make do with less. In other words, managers must strive to maintain or increase productivity and quality levels despite having a smaller workforce. Since downsizing often brings about a flatter corporate structure, the flow of information and communication no longer requires the effort needed prior to restructuring. Therefore, reports used for communication between layers of the old corporate hierarchy, for example, can be eliminated. If redundant but nonessential work cannot be completely eliminated, it perhaps can be reduced. By studying particular tasks and determining their essential components, managers can get rid of unnecessary tasks and eliminate unnecessary jobs altogether.

Downsizing appears to be an ongoing practice for the foreseeable future. Top managers with responsibility for making downsizing decisions are in a difficult predicament. Failure to downsize may result in inefficiencies, while downsizing clearly has a number of potentially negative effects on individuals and communities. Finding the balance between these outcomes is the primary challenge facing these managers.

*SEE ALSO:* Divestment; Quality and Total Quality Management; Strategic Planning Failure

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*Revised by Scott B. Droege*

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# DUE DILIGENCE

Due diligence is a legal term that describes the level of care or judgment that a reasonable person would be expected to exercise in a given situation. The term finds application in a wide range of business

settings, including mergers and acquisitions, occupational health and safety, environmental impact assessments, supplier and vendor relationships, asset purchase decisions, and employee hiring or promotion practices. Performing a due diligence analysis in such situations helps managers make informed decisions and reduce the risks incurred by the business. "Real due diligence analyzes and validates all the financial, commercial, operational, and strategic assumptions underpinning the decision," an analyst for Price Waterhouse Coopers told *Mondaq Business Briefing.* "Due diligence is a strategy to reduce the risk of failure, as well as the embarrassment of discovering what underlies spectacular success," Herrington J. Bryce added in *Nonprofit Times.*

In the area of workplace safety, employers have a responsibility to exercise due diligence in eliminating hazards and creating a work environment that minimizes the risk of accidents or injuries. In fact, due diligence is the legal standard used to determined whether employers can be held liable under occupational health and safety laws. Employers are generally not held liable for accidents if they can prove that they took reasonable precautions to protect workers from injury. Companies can establish due diligence by putting workplace safety policies and procedures in writing, providing appropriate training to employees, and holding managers accountable for following safety guidelines.

Due diligence also applies to the process of making investments, whether personal investments in shares of stock, corporate investments in technology, or the purchase of one company by another. In the area of mergers and acquisitions, a due diligence analysis is an important part of the process of evaluating potential investments and confirming basic information before entering into a transaction. "Quite often, a proposed merger or acquisition gets canned or valued down following conflicts over intellectual property rights, personnel, accounting discrepancies, or incompatibilities in integrating operating systems," wrote Lee Copeland in *Computer World.* "The process of researching, understanding and, in some cases, avoiding these risks is known as due diligence."

When a business makes a purchase offer of any kind, it is often a matter of policy to make the offer contingent on the results of a due diligence analysis. This analysis might include reviewing financial records, hiring experts to examine the assets in questions, and taking other reasonable steps to make sure that all questions are answered and expectations met. Experts suggest that sellers also perform due diligence analysis prior to entering into a transaction. Going through this process helps sellers be prepared for any questions that might arise out of the buyer's due diligence analysis, and also gives sellers a basis on which to evaluate the merits of potential purchase offers.

Although the legal concept of due diligence endured for half a century, it came under siege in the early 2000s following a spate of accounting scandals and revelations of deceit and ethical lapses by senior executives at major corporations. "The issue of due diligence arises whenever a financial transaction generates questions, such as: How could this have happened? How could this have gone undetected for so long?" Bryce noted. Rather than dismissing due diligence as an outdated concept, however, some analysts argued that such incidents underlined the importance of due diligence as way for managers to be informed about and exercise judgment over all transactions that affect the welfare of the business.

In a critique of traditional due diligence practices for *Mondaq Business Briefing,* Charles F. Bacon warned that traditional due diligence tends to be reactive. For example, senior management might order a due diligence analysis after making the decision to purchase a competitor. "In effect, they bought the car and now that the tires are getting kicked, they don't want to hear about the bad transmission or leaky gaskets because that would tarnish the fun of dealmaking," Bacon explained. Instead, he recommended that businesses take a systemic approach to due diligence starting at the top and incorporating due diligence into all organizational decision-making. The ultimate goal is to create a culture of due diligence in which all employees are encouraged to question and explore the implications of financial and strategic decisions.

*SEE ALSO:* Entrepreneurship; Licensing and Licensing Agreements

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