Managerial and Leadership Think-Work Functions

and

Associated Concepts and Practices

Analyzing

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Third Edition

R. D. Cecil and Company
Human Resources Development

Managerial and Leadership Think-Work Functions
And Associated Principles and Practices

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ANALYZING

Basic Perspectives

Although many management models place thought-oriented *Planning* functions ahead of action-oriented *Implementation* functions, they do not identify *Analyzing* as a separate major function and emphasize its importance as the first step in think-work processes.

All managers make decisions. Many set goals and formulate plans. Quite a few, however, do not analyze the situation first. And, those who do, tend not to analyze it as thoroughly as they should.

In short, Analyzing tends to be the least often and least effectively performed integrative function.

Definitions of Analyzing

A Dictionary Definition[5]: Separating a whole into its component parts; examining a complex, its elements, and their relationships; studying or determining the nature of the whole and the natures and relationships of the parts with respect to each other and the whole.

A Management Definition: Identifying factors or variables both inside and outside an organization that are affecting its operational success, and determining (a) causes and effects, and (b) which factors or variables should (and can) be changed or improved.

Basic Analytic Steps

Although there may be many analytic steps involved in planning and problem-solving situations, these are the most basic steps:

1. Describe unintended/unexpected/dysfunctional events or situations

2. Develop a conceptual analytic framework (diagram or model of factors/variables involved)

3. Research/collect facts/data associated with the factors/variables identified

4. Incorporate the facts/data into the conceptual model (connect facts to appropriate factors)

5. Analyze models/data and identify significant cause/effect relationships among variables

    a. In problem-solving situations, identify "the problem" (not one but all the major causal factors)

    b. In goal-setting/planning situations, identify the key variables that must be changed or improved in order to meet goals

6. Identify criteria for evaluating/comparing alternatives (solutions or sets of goals/plans) during decision making)

Purposes and Benefits of Analyzing

In our view, the purposes and associated benefits of analyzing make it a KEY think-work function, and, therefore, one of the most important of all integrative functions. The main purposes of analyzing are:

1. To view the "Big Picture"—that is, to enable managers to construct an overview of, and to gain important insights into, how systems of factors both inside and outside the organization are influencing each other:

    a. how external industry and marketplace factors or variables tend to affect each other;

    b. how external technological, economic, political, geographic, socio-cultural, climatic, and other outside forces or factors tend to affect the industry or business;

    c. how internal (organizational) marketing, financial, research, development, manufacturing, facilities, and human resources factors or variables are affecting each other;

    d. how internal (organizational) task/technological, organizational, individual, and social factors or variables are affecting each other; and

    e. most important, how each of the four groups or systems of factors mentioned above are tending to affect each other.

2. To "line up the ducks" before going on to goal setting/planning or formulating solutions.

a. To determine what is going on both inside and outside the organization—especially that which is either unintended, unexpected, undesired, or otherwise dysfunctional for organizational, unit, or individual success.

    1. To identify previously unrecognized problems.
    2. To determine whether or not previously recognized problems have been fully solved.
    3. To identify opportunities to improve things (e.g., attitudes, interactions, and activities—all of which affect individual and organizational performance).

b. To determine why (to determine what factors or variables are either influencing a situation or causing a problem).

    1. To distinguish between causes and effects.
    2. To identify cause/effect relationships among factors or variables.
    3. To identify sequences of causes and effects, thereby identifying the "real, underlying causes" (and distinguishing them from the superficial causes).

c. To identify which factors or variables should (and actually can) be changed or improved.

3. To establish bases and inputs for effective goal setting. Identifying important factors or variables actually makes the following rather obvious:

    a. the factors/variables that goals should be aimed at changing or improving (and around which goals may be written):

        1. the underlying causes of previously unrecognized problems;
        2. the underlying causes of existing problems (that have not yet been fully solved); and
        3. other factors/variables, which, if improved or changed, could also significantly improve organizational, unit, and/or individual performance.

    b. the most appropriate parameters/criteria (yardsticks) to use for evaluating organizational, unit, sub-unit, and individual performance.

4. To establish bases and inputs for effective planning (or formulation of alternative solutions). Identifying sequences of causes and effects actually makes the following rather obvious:

    a. how affecting each factor (or groups of factors) tends to affect another (or others);
    b. which factors must be changed or improved in order to change or improve others; and
    c. the steps that should be incorporated into plans (in order to deal with various factors).

5. To establish bases/inputs for effective decision making. Fully analyzing systems of causes and effects usually makes the following more apparent during decision making:

    a. what criteria should be used to evaluate, and choose among, alternatives;
    b. various scenarios involving alternative actions and possible resulting events; and
    c. comparative advantages and disadvantages of alternatives.

Types of Factors/Variables that Can Be Analyzed

The following are several rather distinct groups of factors/variables. In most goal-setting and planning situations, they should all be identified, modeled, and analyzed. In problem-solving situations, which factors in which groups are analyzed depends on the situation.

Industry/Business-Related Factors/Variables

Examples: industry/market definition and scope; structure of the industry/business; natures of competitors; consumers and their consumption patterns; competitive marketing strategies and tactics; competitive marketing practices involving the marketing mix (products, pricing, push and pull promotion, channels of distribution, and packaging); research and development efforts; production or manufacturing capacities, processes, technologies, facilities, productivity, inputs, and costs; transportation modes; sources/suppliers or subcontractors; financial structures/systems; and human resources

A more detailed checklist of these factors is provided in **Exhibit A** on page A-4.

Environmental (External) Forces/Factors Affecting the Industry/Business

Examples: economic factors; technological factors; other industries (and their substitutable products); governments (both domestic and foreign); politics; foreign competition; raw materials; suppliers, vendors, and subcontractors; financial markets and institutions; industry associations; labor unions; special interest groups; socio-cultural phenomena; and climatic phenomena

A more detailed checklist of external forces and factors is provided in **Exhibit B** on page A-5.

Note that there is some overlap between this group of factors and the previous group.

Internal/Organizational Function-Related Factors

Examples: **marketing factors** involving sales, advertising, and market research; **financial factors** involving profits, return on investment, and the management of assets and liabilities; **research and development factors** involving pure research, applied research, facilities, and product development; **production factors** involving engineering, purchasing, manufacturing operations, maintenance, warehousing, and shipping; **facilities-related factors** dealing with plant, equipment, offices, and property; **organizational variables** involving structure and systems; and **human resources factors** such as hiring, compensation, and training/development practices

Checklists of marketing, research and development, production, facilities, organizational, and human resources factors can be developed by an organization's respective departments. Checklists of industry factors, external factors, and internal factors can be used to help develop such checklists.

Internal/Organizational Task, Organizational, Individual, and Social Factors/Variables

Examples: **task or technological factors** such as job objectives/descriptions, technical/functional tasks, managerial/supervisory tasks, equipment/tools utilized, materials/services/information inputs and outputs, task/job interrelationships and interdependencies, job skill requirements, and characteristics of tasks; **organizational factors** such as objectives and strategies, history and traditions, formal and informal structures, key integrative and decision-making points, policies/procedures/rules, information and control systems, and managerial/supervisory styles and practices; **individual factors** such as basic needs/drives, values, personality traits, technical/functional skills, interpersonal skills, and managerial/supervisory skills; and **social factors** such as the norms of various units or groups, the roles of group members, and the interpersonal relationships between individuals and organizational units

A more detailed checklist of these factors is provided in **Exhibit C**. It is based on the Socio-Technical Model developed by Eric Trist.[6]

Note that there is overlap between these factors and the factors in the previous group.

Corresponding Information That Can be Analyzed

For any factor or variable, there is some corresponding bit of information or piece of data that can be analyzed. Here we (a) distinguish between "information," "non-quantitative information," and quantitative/numerical "data"; (b) define "bits" and "strings/series" of data; (c) define current, historical, and projected (forecasted) data; (d) discuss sources of information; (e) discuss characteristics of information; and (f) distinguish between facts and assumptions.

Basic Definitions

Information — We use the word "information" to refer to both non-quantitative information and quantitative information.

Non-Numerical Information — We use this term to refer to information that is not expressed in numerical form. *Examples:* The information relating to the factor "major competitors" is a list of major competitors. The information relating to the factor "social norms of a group" is a list of the normative attitudes, expectations, and behavior patterns of a group.

Data — This word refers to information expressed in quantitative or numerical terms. *Examples:* The data corresponding to the factor "total unit sales" is expressed as a

Exhibit A: Major Industry/Market Factors/Variables

Industry/Market Definition/Scope
Type of industry/business (SICs)
Types/classes of goods/services
Size/scope of total market
  Total sales
  Geographic area
State of market segmentation
Position on life cycle of market
Basic cost structure

Structure of Industry
Types/classes of competitors
Number of competitors
Extent of hori./vert. integration
Competitors' product mixes
Competitors' shares of market
Basic traditions/practices
Entry (requirements/barriers)

Consumer/User Profiles
Demographics
Reasons for purchasing/consuming
Consumption/usage patterns
Purchasing patterns
Information needs
Influences on purchase decisions
Influencers of purchase decisions

Competitive Marketing Phenom'a
Product/service groupings
Product/service descriptions
Basic marketing strategies
Basic marketing tactics

Marketing Mix Factors:
Product(s)/Service(s)
  Descriptions
  Product mixes
  Features
  Technical sophistication
  Performance
  Usage benefits/advantages
  Bases of product differentiation
  Bases of brand differentiation
  Substitutability of other products
  Patents/trademarks/copyrights

Channels of Distribution
  Types of channels
  Services provided by channels
    Warehousing
    Sales
    Physical distribution
  Channel practices
  Channel performance
    Inventory turnover
    Delivery
  Channel risks/needs
  Incentives to channel(s)

Promotion
  Promotional strategies/tactics
  Pull (advert.) media used
  Push (sales) media used
  Promotability of product(s)
  Promotability of brands
  Pull mode media practices
  Push mode media practices
    Salesforce practices
    Point of Sale practices
  Push/pull mode/media costs

Pricing
  Supply/demand situation
  Consumer price sensitivity
  Life cycle of products
  Costs / break-even points
  Profit margins
  Pricing strategies/tactics
  Pricing structures
  Pricing practices/policies
  Contract pricing practices

Packaging
  Design / materials
  Costs

Market Research Practices

R&D / Engineering
Technological Sophistication
Patents
Facilities/Equipment
Coordination w/ Production

Production
Productive capacity
Technology involved
Processes involved
Capital vs. labor intensity
Facilities
  Plant/warehouse sizes
  Plant/warehouse locations
Machinery/equipment
  Capabilities
  Flexibility
  Maintenance
Resources/parts inputs
Quality/quantity standards
Productivity
Production costs
  Materials/resources
  Direct & indirect labor
  Allocated costs

Transportation
Patterns of rcpts/shipments
Modes used
Rates/costs

Sources/Suppliers
Locations
Quality
Reliability
Pricing

Financial
Operating data/ratios
Profitability
Return on investment
Cash flows / liquidity
Accounting practices
Debt/equity structures
Capital sources
Capital costs

Organizational
Objectives/priorities
Values
Traditions
Structures
  Degree of centralization
  Departmentation
  Levels/spans of control
Managerial styles
Management Systems
  Goal setting & planning
  Decision making
  Information/control
  Evaluation/reward

Human Resources
Management skills
R&D skills
Work force skills
Sales force skills
Salary/wage scales
Working conditions
Attitudes/motivation
Turnover

Exhibit B: Significant External/Environmental Factors That Influence Organizations

Economic

General
- Employment
- Inflation/deflation

Consumer-Related
- Job market
- Disposable income
- Consumer savings
- Consumer debt
- Consumer price index
- Consumer spending
  - Durable goods
  - Services
  - Consumables
- Consumption patterns

Business/Industry
- Production
- Shipments
- Inventories
  - Raw materials
  - Work in process
  - Finished goods
- Finished goods prices
- Wholesale prices
- Distribution mark-ups
- Profits
- Dividends
- Employment
- Spending on . . .
  - Capital projects
  - Services
  - Labor
  - Raw materials
  - Energy

Financial
- Interest rates
  - Discount rate (Fed)
  - Mortgage rates
  - Prime rate
  - Consumer loan rates
- Money supply
- Velocity of money
- Multiplier
- Markets . . .
  - Stocks/bonds prices
  - Commodities prices
  - Foreign exchange rates

Government-Related
- Monetary policies
- Fiscal policies
- Trade policies
- Taxes
- Government Spending
  - Defense
  - Social welfare
  - Revenue sharing
  - Budget deficit/surplus

Political/Governmental

(Federal/State/Local)

Executive Branch
- Departments / agencies

Legislative Branch
- Legislation
  - Incorporation
  - Anti-trust
  - Unions
  - Taxation

Dept./Agency Regulations:
- IRS; OSHA; EPA; EEO
- Federal Trade Commission
- Interstate Commerce Comm.
- Codes

Judicial Branch

International Relations
- Treaties / agreements

Political Parties

Technological

- Agricultural
- Medical
- Engineering
- Aviation
- Computers
- Robotics
- Materials
  - Catalysis
  - Semiconductors
  - Plastics
  - Fiber optics
- Mathematics
- Sciences
  - Physics
  - Chemistry
  - Bioengineering
  - Biology
  - Biophysics
  - Neurophysics
  - Astrophysics
  - Electronics
  - Genetics
  - Climatology
  - Mechanics
  - Metalurgy
  - Optics
  - Psychology

Resources

Raw Materials
- Reserves

Energy
- Petroleum reserves
- Refining capacity
- Production capacity
- Nuclear

Social/Cultural Variables

- Population demographics
- Population growth
- Population migration

Social Norms/Customs
- Morality/ethics
- Work ethic
- Socialization of the young

Other Factors/Variables

Foreign Entities
- Governments
  - Domestic policies
    - Monetary policies
    - Fiscal policies
  - Trade policies
- Competitors
  - Products
  - Marketing practices
  - Costs / prices

Sources/Suppliers

Transportation
- Modes
- Facilities

Communications
- Modes
- Facilities

Labor
- Work force (#, skills)
- Unions

Industry Associations

Special Interest Groups
- Environmental
- Political action

Natural Phenomena
- Weather
- Geography

Exhibit C: Checklist of Major Factors That Influence Organizational Behavior

TASK FACTORS

Job descriptions
- **Objectives**
- **Activities**
  - Technical/functional
  - Managerial/supervisory
    - analyzing, goal setting,
    - planning, budgeting
    - problem solving
    - decision making
    - organizing, staffing
    - directing, coordinating
    - reporting, evaluating
- **Equipment or tools**
- **Material inputs/outputs**
- **Information inputs/outputs**

Work load -- work flow
Communication facilities
Working conditions
Task interrelationships
Technology
Job input requirements
- General/basic abilities
- Specialized skills
- Knowledge/experience
- Other behavior patterns

General Natures
- (Mechanistic or Organic)
- Complexity
- Variability
- Clarity of definition
- Amount of change
- Certainty of information
- Time to outputs/results
- Tangibility/measurability (of outputs/results)

ENVIRONMENTAL INPUTS

Business-Oriented Factors
- Customers, suppliers
- Competitors
- Industry associations
- Worker unions

Institutions
- Government agencies
- Religions
- Capital markets
- International institutions

People-Oriented Factors
- Families, peers
- General public, community
- Social norms and customs
- Religious affiliations
- Social/recreational groups
- Interest groups

Other
- Technology, economy
- Transportation facilities
- Nature, weather, energy
- Goods and services

INDIVIDUALS' CHARACTERISTICS

Motivators
- **Basic needs or drives**
  - physiological, safety
  - social, self-image
  - self-actualization
- **Values**
  - intellectual, economic
  - social, political
  - aesthetic, religious
  - practicality, achievement
  - variety, goal-orientedness
  - orderliness, decisiveness
  - support, conformity
  - recognition, independence
  - benevolence, leadership
- Interests (occupational)
  - mechanical, outdoor
  - computational, scientific
  - clerical, persuasive
  - artistic, musical, literary
  - social service
- Goals and expectations

Capabilities
- **Abilities**
  - academic intelligence
  - vocabulary, social insight
  - mechanical visualization
  - mechanical i
  - clerical speed & accuracy
  - physical coordination
  - reading, communication
- **Specialized (job) skills**
- **Knowledge & experience**
- **Physical traits**

Personality traits
- self-confidence
- dominance, sociability
- social conscientiousness
- adaptability, maturity
- original thinking, vigor
- responsibility, self-control
- emotional stability

SOCIAL VARIABLES

Group Formation
- People's needs & drives
- Tasks' interdependence
- Proximity & work flow
- Frequency of interactions
- Members' characteristics
- Valued/shared traits

Intra-Group Relationships
- Group norms & customs
- Members' status & roles

Group Maintenance
- Enforcing sanctions
- Conflict resolution
- Image reinforcement
- Membership norms

Sources/frequency of conflict
Interaction w/ other groups
Influence on organization

ORGANIZATIONAL INPUTS

History and traditions
Key elements of success
Objectives and strategies
Resources
Structures
- Key integrative points
- Key decision-making points
- Formal Structure
  - Units/departments
  - Vertical relationships
  - Horizontal relationships
  - Levels/spans of control
- Informal structure

Policies, rules, procedures
- Formal and informal

Inter-unit interactions
- Sources of conflicts

Contacts with environment
Systems
- Information Systems
- Control Systems

Practices
- Performance evaluation
- Wages/salaries/benefits
- Hiring/selection/promotion
- Training and development

Natures of tasks
Natures of people
Managerial/leadership styles and practices
- Authority base (position vs. expertise)
- Formality to subordinates
- Nature of communications
  - advice and information
  - instructions and decisions
- Degree of control
- Specificity of subordinates' responsibilities & authority
- Conflict resolution
- Subordinates' participation:
  - Goal setting & planning
  - Problem solving
  - Decision making
  - Development of methods, procedures, policies
- Assumptions/facts about subordinates
- Task orientation
- People orientation

General nature of organiza tion (mechanistic/organic)

Exhibit D: Various Economic and Business Indicators

Leading Indicators

Liabilities of business failures
Standard & Poors Index of 500 Common stock prices
New ($) orders - durable goods
New building permits for private housing units (number)
Commercial and industrial building contracts (floor space)
Average work week (mfr'g)
New incorporations (number)
Indust'l matls index (13 commod)

Roughly Coincident Indicators

Employment in nonagricultural establishments
Unemployment
Corporate profits after taxes
Manufacturing & trade sales ($)
Value of goods output ('72 $s)
Industrial production index
Gross national/domestic product
Wholesale price index (industrail commodities)

Lagging Indicators

Personal income ($)
Sales by retail stores ($)
Consumer installment debt ($)
Bank rates on business loans
Manufacturing and trade inventories (book value)

Other Economic/Business/Financial Indicators

Stocks
Price-earnings ratio (S&P 500)
Dividend yield (S&P 500
Dow Jones Industrial Average
Lipper Growth Mutual Fund Index
Avg. daily NYSE vol. (mil. shares)

Bonds
New Aaa utilities
New Aa industrials
U.S. Governments
Bond buyer 20 municipals

Money Markets
Federal funds
Prime rate
Mortgage rates
Commercial paper (3-month)
New treasury bills (3-month)
New treasury bills (6-month)
Certificates of deposit (3-mo.)

Monetary Indicators
Money supply (M1) (billions)
Banks' business loans (billions)
Free reserves (millions, 2-wk pd.)
Commercial paper - nonfinancial (billions)

Foreign Exchange
German mark
Swiss franc
Japanese yen
British pound
Canadian dollar
French franc
Mexican peso

Production
Raw steel production (tons)
Steel shipments (tons)
Automobile production (units)
Truck production (units)
Electric power (kilowatt-hours)
Oil refinery runs (barrels)
Bituminous coal (tons)
Paperboard (tons)
Paper (tons)
Lumber (feet)
Rail-freight traffic (ton-miles)

Business Week Leading Indicators
S&P stock prices
Corporate bond yield (Aaa)
Industrial materials prices
Business failures
Real estate loans (billions)
Money supply (M2) (billions)
Initial claims, unemployment Insurance

Prices
Gold
Finished steel composite
Foodstuffs (9 commodities)
Copper
Aluminum, primary ingot
Wheat
Cotton

Other
Consumer price index (CPI)
Orders for durable goods
Real gross weekly pay

number—e.g., 10,000 units. The data corresponding to the factor "total dollar sales" is expressed numerically in dollars—e.g., $100,000.

Bits and Strings/Series of Data

A "bit" of numerical data is a single number—usually for one time period (e.g., month, quarter, or year). For example, the "total dollar sales for 1989" is one number.

A "string" or "time series" of numerical data is a group or list of bits of data, which is usually arranged in a chronological sequence over some number of time periods. *Example:* "net profits from 1995 through 1996" would be a string or series of numbers consisting of bits of data for each of the eleven years.

Current, Historical, and Forecasted Data

Current Data — This is the factor-related data for the current day, week, month, quarter or year. (Since it is for one time period, it is a "bit" of data.)

Historical Data — This is the factor-related data recorded for one or more past time periods. (If it is for one time period, it is a "bit" of historical data. If it is for more than one time period, it is a "string" or "series" of historical data.)

Forecasted Data — This is the factor-related data projected for one or more time periods. (If it is for one time period, it is a "bit" of forecasted data. If it is for more than one time period, it is a "string" of forecasted data.)

Strings or time series consisting of current and historical data are used to detect upward, level, downward, or irregular trends in factors such as sales, costs, consumer attitudes and behavior patterns, business attitudes and behavior patterns, technological phenomena, economic phenomena, and sociological phenomena. In turn, current data, historical data, and trend analyses are used to make forecasts or projections about the future.

For forecasting purposes, some business and economic factors are considered *leading indicators*, some are considered *coincident indicators*, and some are considered *lagging indicators*. **Exhibit D** (previous page) is a list of various business/economic indicators.

Leading indicators are those factors that tend to rise or fall several months or more prior to an economic upturn or downturn. For example: An increase in "new housing permits" is usually a precursor of an upturn in the construction industry, related industries, and the general economy. On the other hand, an increase in the "liabilities of business failures" is usually a precursor of a business and economic decline.

Coincident indicators such as unemployment, industrial production, Gross Domestic Product (GDP), and the Wholesale Price Index) tend to rise or fall more or less concurrently with the economy.

Lagging indicators are those factors that tend to rise or fall several months or more following an economic upturn or downturn, and, therefore, confirm that an economic expansion or contraction is actually occurring.

Forecasting methods will be discussed later.

Sources of Information

Information corresponding to industry/business-related factors/variables and to
Environmental (external) forces/factors affecting the industry/business **Exhibit E** lists various sources of general information, specific data, trend data, and forecasts pertaining to industry factors, business/economic factors, technological factors, socio-cultural factors, and climatic factors.

Information corresponding to internal function-related factors Information concerning internal R&D, production, marketing, financial, and human resources activities and performance is normally obtainable from an organization's finance, accounting, personnel, and/or data processing departments.

Information corresponding to internal socio-technical factors Much information regarding *task-related/technological factors* is normally available from sources such as job descriptions, goal-setting forms, procedures manuals, machine specifications, floor plans of work areas, production records, and manuals of skill and training requirements. Additional information can be obtained through direct observation of equipment, facilities, activities, and results.

Exhibit E: Sources of Industry/Environment Information and Forecasts

On the Industry/Marketplace

From competitors
- Products; product manuals
- Advertising
- Promotional materials
- Annual reports/meetings
- Press releases
- Books, articles
- Speeches
- Personnel changes
- Employment ads

From public sources
- Books, articles
- Case studies
- Newspapers / reporters
- Business school libraries
- Environmental groups
- Consumer groups
- Unions

From Private Firms
- Recruiting firms
- Clipping services
- Advertising agencies
- Management service firms
- Public relations firms
- On-line computer databases
- Catalogers / direct mailers
- Think-tanks
- SIC code manuals
- Thomas's Register
- Credit reports (D&B)
- Consulting firms (studies):
  - Moody's Investor Service
  - FIND/SVP, Inc.
  - The Conference Board: Surv. of Consumer Attitudes & Buying Plans
  - Sales & Marketing Inst.
  - Brandon Applied Systems

From federal/state entities
- SEC reports (10-Ks)
- Dept. of Commerce: *Census of Manufacturers; Annual Survey of Mfrs*
- *The Congressional Record*
- Lawsuits (testamony)
- Antitrust suits
- Govt. budgets/programs
- National plans
- Licenses/patents/copyrights
- Univ. of Mich.: *Surveys of Consumer Attitudes*

From financial institutions
- Banks
- Brokerage Ffrms / brokers
- Prospectuses
- Stock/bond issues
- Security analysts' reports
- Industry studies

From trade/industry assn.s
- Industry studies/reports
- Technical papers
- Courses / seminars
- Trade shows/conventions
- From other sources
- Purchasing agents
- Suppliers/vendors
- Distributors/wholesalers
- Subcontractors
- Customers

On the Economy/Business/ Trade

From financial periodicals - e.g.:
- *Journal of Finance; Banking*
- *Nation's Business;*
- *Business Week*
- *Forbes; Fortune; Barron's*
- *Wall Street Journal*
- *Comm'l & Fin'l Chronical*

From financial institutions
- Major banks; Dow Jones;
- Standard & Poors
- Stock exchanges
- Commodity exchanges
- International Monetary Fund: *Internatl. Financial Statistics*

From research/forecasting firms:
- Chase Econometrics Assoc.
- Data Resources, Inc.
- Predicasts, Inc.
- Wharton Econometric Forecasting Assn.
- Economic Information Systems, Inc.; Washington Researchers, Inc.

From government entities' (reports)
- Dept. of Agriculture
- Dept. of Labor: *Employment & Earnings Monthly Labor Review*
- Dept. of the Treasury, Office of Management & Budget
- Dept. of Commerce - *Survey of Current Business; Business Cycle Developments; Consumer Sentiment Index; U.S. Industrial Outlook*
- Dept. of Commerce, Bureau of the Census: *State & Metro Area Data Book; Population Estimates; U.S. Census of Population, Gen'l Social & Economic Characteristics; Statistical Abstract of the U.S.; Business Conditions Digest*
- U.S. Govt. Printing Office: *U.S. Industrial Outlook*
- Library of Congress - National Referral Center
- Nat'l Bureau of Economic Research
- Federal Home Loan Bank Board
- Economic Report of the President
- Council of Economic Advisors
- Fed'l Reserve Bank/Board
- Fed'l Deposit Ins. Corp.
- Internal Revenue Service
- U. S. Trade Commission

On Technology
- U.S. Patent & TM Office: *Official Gazette*
- Technical conferences
- Scientific societies
- Scientific journals
- Technical schools
- University studies
- Industry publications
- Think-tanks

On Social/Cultural Trends
- Books / articles
- University publications
- Library of Congress
- Public libraries
- University libraries
- *UN Statistical Yearbook*
- U.S. Dept of Health and Human Services
- Bureau of the Census

On Climatic Conditions
- U. S. Weather Service
- University publications
- Scientific journals

Much information regarding *organizational factors* is available in organization charts, job descriptions, policies and procedures manuals, promotional brochures, and financial reports. Some information must be obtained through observation of activities and through conversations with long-time employees.

Some information regarding *individuals' characteristics* can be found in personnel files—if one has access to them. However, insights into individuals' drives, values, interests, goals, and personality traits must usually be developed through observation of job-related and interpersonal behavior.

Little information about *social factors* is available. Insights into individuals' and groups' interactions must generally be gained through observation of behavior.

Characteristics of Information

Validity: Information regarding a particular factor is valid if, indeed, it exactly corresponds to that factor—and not to some other factor or sub-factor. For example: If one actually wants data on "total units of industry sales," it is not valid to use data concerning "total units of industry production." The industry may not have sold all the units that it produced during a given time period.

Reliability (Credibility): The reliability of information is largely a function of (a) the conscientiousness, skill, and honesty with which it has been collected, maintained, and/or processed, and (b) the reasons for which it has been collected, maintained, processed, and/or released/disseminated. In general, information can be considered reliable if . . .

a. its original source can be considered (has proven itself to be) "completely reliable and credible";
b. the source that actually provided it can be considered reliable; and
c. its credibility can be confirmed by some other reliable source.

It should be kept in mind that both individuals and organizations sometimes provide disinformation to other sources in order to mislead those who obtain information from those sources.

Completeness: Very simply, information is complete when there are no relevant bits of information missing. Unfortunately, because there is not "perfect knowledge" about any factor or situation, most information is incomplete to some degree. Thus, not only is it virtually impossible to obtain information concerning all the factors being analyzed, but it is also virtually impossible to obtain all the relevant information concerning any single factor. For example, the following are common phenomena: (a) "total" data for certain industries is incomplete and therefore inaccurate (because one or more competitors do not report certain operating or financial data); (b) data for all the years desired is not available; or (c) all the information concerning a problem situation cannot be obtained.

When needed data is missing, it may be necessary to either (a) research additional sources, (b) delve more deeply for information and insights concerning a situation, or (c) make "working assumptions" to use in place of the missing information. Unfortunately, since doing (a) and (b) first takes time and effort, many individuals often make "quick and dirty assumptions" that turn out to be erroneous.

Accuracy: Accuracy of information is a function of (a) the skill and conscientiousness with which it was originally collected and subsequently processed; (b) its completeness; and (c) the reliability (trustworthiness) of the sources who originally and subsequently handled it. Determining the accuracy of information essentially involves . . .

a. verifying the reliability of all sources;
b. validating any assumptions or conclusions on which the collection and processing of the information may have been based; and
c. verifying the completeness and accuracy of the information through other sources (if possible).

Making Working Assumptions

One of the most fundamental rules is: Base analyses on facts rather than assumptions. This, however, is not always possible. When information is unavailable, or when the available information is believed to be unreliable, incomplete, and/or inaccurate, it may be necessary to make working assumptions about the information (e.g., estimating figures that are believed to be "in the ball park").

Caution: Basing analyses and final conclusions on too many assumptions can be dangerous. When assumptions must be made or figures must be ball-parked, they should be based on (verifiable) facts to the greatest extent possible. In addition, individuals' assumptions, estimates, and conclusions should not automatically be treated as though they were facts.

Individuals should clearly distinguish between facts and their own or others' assumptions, estimates, and conclusions.

Psychological Phenomena Involved in Analyzing

Mental Inputs

Knowledge, experience, mental abilities, motive/attitudinal traits, and personality traits all influence the effectiveness and efficiency with which individuals analyze a situation. An individual's levels of these inputs influence the depth of his/her insight into a situation and how appropriately he/she identifies causes and effects.

1. **Knowledge and Experience**

   a. Knowledge of, and experience using, analytic approaches/mehods: These inputs influence how well an individual structures and performs the analytic process.

   b. Knowledge/experience concerning factors/variables (and their interactions): These inputs affect which and how many (potentially) causal or influential factors/variables an individual will identify and consider when attempting to gain insight into the situation.

   c. Knowledge of facts/data corresponding to the factors/variables: This knowledge influences (a) how much information an individual will be able to attach to the factors/variables (without having to research and collect additional, more detailed, or more accurate information); and (b) the validity of his or her working assumptions and final conclusions.

2. **Mental (Logical) Abilities**

   a. Ability for class (deductive) logic: This is the ability to define and describe objects and activities in terms of their characteristics, and then to compare and contrast them and identify the similarities and differences between them. An individual's level of this ability influences the effectiveness with which he/she indentifies significant factors/ variables and their interrelationships.

   b. Ability for propositional (inductive) logic: This is the ability to apply knowledge and experience when thinking ahead and asking, "What might happen if . . ." An individual's level of this ability influences the effectiveness with which he or she identifies cause and effect relationships among variables.

3. **Motive/Attitudinal and Personality Traits**

Individuals' levels of these traits greatly influence (a) which factors they identify and consider, and (b) how well they analyze them. The following are several generalizations:

a. Individuals who are relatively high in the economic and practical-mindedness values (concerns for money, material things, financial success, and practicality) and in the political value (concerns for having power, authority, or influence over other people) tend to identify and consider the more task-oriented ("mechanical"/practical) and political aspects or factors associated with the industry, the environment, and internal operations. They tend to overlook if not ignore the individual and social factors involved.

b. Individuals who are relatively high in the more people-oriented values and personality traits—such as the social value (altruistic love of and concern for people), the benevolence value, social conscientiousness, social maturity, and sociability—tend to identify and consider the more people-related aspects and factors associated with the industry, the environment, and internal situations. They tend to overlook if not ignore other factors.

c. Individuals whose values and personality traits are more "balanced" have a greater tendency to identify and consider all the aspects or factors involved in a situation.

d. Those who are rather high in traits such as the intellectual or theoretical value, original thinking, orderliness, and self-control tend to be the most analytic.

4. **Creativity**

When most people hear the word "creativity," they tend to equate it with "brainstorming new and innovative plans or solutions." Actually, creativity begins during the analysis phase rather than the formulation of plans or solutions phase. It is largely a function of the insights an individual develops when initially analyzing a situation.

Creativity is also largely a function of several personal characteristics. In general, the higher the levels of the following characteristics, the greater an individual's creative potential:

a. knowledge and experience concerning the factors and corresponding facts directly associated with the situation or problem;
b. knowledge and experience concerning factors and corresponding facts associated with other systems of factors;
c. knowledge of factors, facts, concepts, and principles associated with other fields of knowledge;
d. abilities for class (deductive) logic and propositional (inductive) logic; and
e. the theoretical (intellectual) value and "original thinking" (a personality trait).

Together, these inputs enable an individual to (a) "think outside" the situation, (b) relate other knowledge and experience to the situation, and (c) integrate concepts, information, and experience in a manner that generates fresh or novel insights and ideas.

Rules/"Secrets" of Analyzing

There are at least three major rules for analyzing situations effectively. Some people are aware of them, and some are not. Those who are aware of them often forget to follow them.

Rule 1: Analyze the situation thoroughly first—before going on to the second and third phases of the analytic approach. Many individuals are aware of this rule, but still cannot break the bad habit of jumping back and forth between (1) analyzing the situation, (2) formulating a number of alternative solutions or alternative sets of goals/plans, and (3) decision making (evaluating, comparing, and choosing among alternatives).

Rule 2: Do a qualitative analysis before doing a quantitative analysis. In other words, it is not wise to start "pushing numbers" right away. It is first necessary to "line up the ducks" (identify the most significant factors) in order to make sure that one will be collecting and pushing the right numbers (the data that corresponds to the most influential variables or to the real, underlying causal factors). This means doing the following:

a. reviewing checklists of relevant factors, making sure that one has "covered all the bases" (has identified all the significant influential or potentially causal factors involved); and
b. analyzing the factors to determine which are significant enough to warrant researching, collecting, and massaging the data relating to them.

Rule 3: Use visually-oriented models (diagrams) to help do qualitative analyses, and use mathematically-oriented models and tools to help do quantitative analyses. These analytic aids enable the human mind to do what it is incapable of doing alone: keep track of, juggle, manipulate, and relate an enormous number of details.

Analytic Approaches and Tools

The following are the most helpful and widely used qualitative (visual) and quantitative (mathematical) tools. They include: (a) visual diagrams/models; (b) methods for formatting and displaying data; and (c) operations research (OR) techniques and tools.

Visual Models/Diagrams

Visual models/diagrams are basically qualitative diagrams of factors/variables and their interrelationships. However, non-quantitative information and quantitative data can be added to them. They enable individuals to view virtually hundreds of important factors (and associated facts) at one time. This leaves their minds free to develop insights into:

a. the natures of the factors (e.g., the characteristics of the organizations, entities, people, tasks, etc.);
b. the flows of materials, services, or information between factors such as tasks and people;
c. interdependencies and interactions among factors; and
d. cause and effect relationships among the factors.

As a result, it also enables them to . . .

a. identify previously unrecognized problem situations and their causes;
b. discover opportunities to improve situations;
c. develop insights into how to gain competitive advantages; and
d. identify ways to integrate tasks and people more effectively, thereby contributing to more effective organizational, unit, and individual performance.

Several types of diagrams/models can be used to analyze systems of factors qualitatively: (a) industry/environment models; (b) maps; (c) organization charts; (d) time lines; and (e) physical area (work area) diagrams.

A. Industry/Environment Models

Although the industry factors listed in **Exhibit A** and the environmental factors listed in **Exhibit B** can be diagrammed separately, it is more advantageous to diagram these two systems of factors/variables together. The industry (a system of factors involving sub-systems of factors) operates within the environment (a larger system of factors involving sub-systems of factors, one of those sub-systems being the industry). In other words, industry factors such as competitors, suppliers, and customers are significantly influenced by environmental factors such as the economy, technology, government, geography, climate, and sociological phemomena. An integrated industry/environment diagram is capable of showing (a) the many interrelationships among factors involved, and (b) what is going on and why. Separate models are not.

Figure 3 on the next page is a very small and simplified example of this type of model. [It should be pointed out that the seminar-size industry/environment (strategic planning) models we have developed for our clients have required a space as large as 20-32 feet long by 8-10 feet high. When normal-size printing is used on double-wide flip-chart sheets, these can be reduced to an area approximately 4-5 sheets wide by 2-3 sheets high.]

Note the following in **Figure 3**:

a. It is generally advisable to diagram the industry as a sub-system or sub-construct, with environmental sub-systems of factors positioned appropriately above, below, and to the sides (e.g., suppliers to the left, and channels of distribution and customer groups to the right).
b. As the diagram is analyzed, dashed lines with arrows can be used to show flows of materials, services, and information among factors, and solid lines with arrows can be used to indicate cause/effect relationships among factors.

B. Maps

As appropriate, world, national, regional, state, and local maps are often used to diagram and analyze the following industry and environmental factors:

a. the geographic locations of (a) the organization's facilities, (b) competitors' facilities, (c) suppliers' facilities, (d) distributors' facilities, and (e) customer/consumer groups;
b. the geographic boundaries of markets and sales territories; and
c. transportation modes/routes/rates.

C. Organization Charts

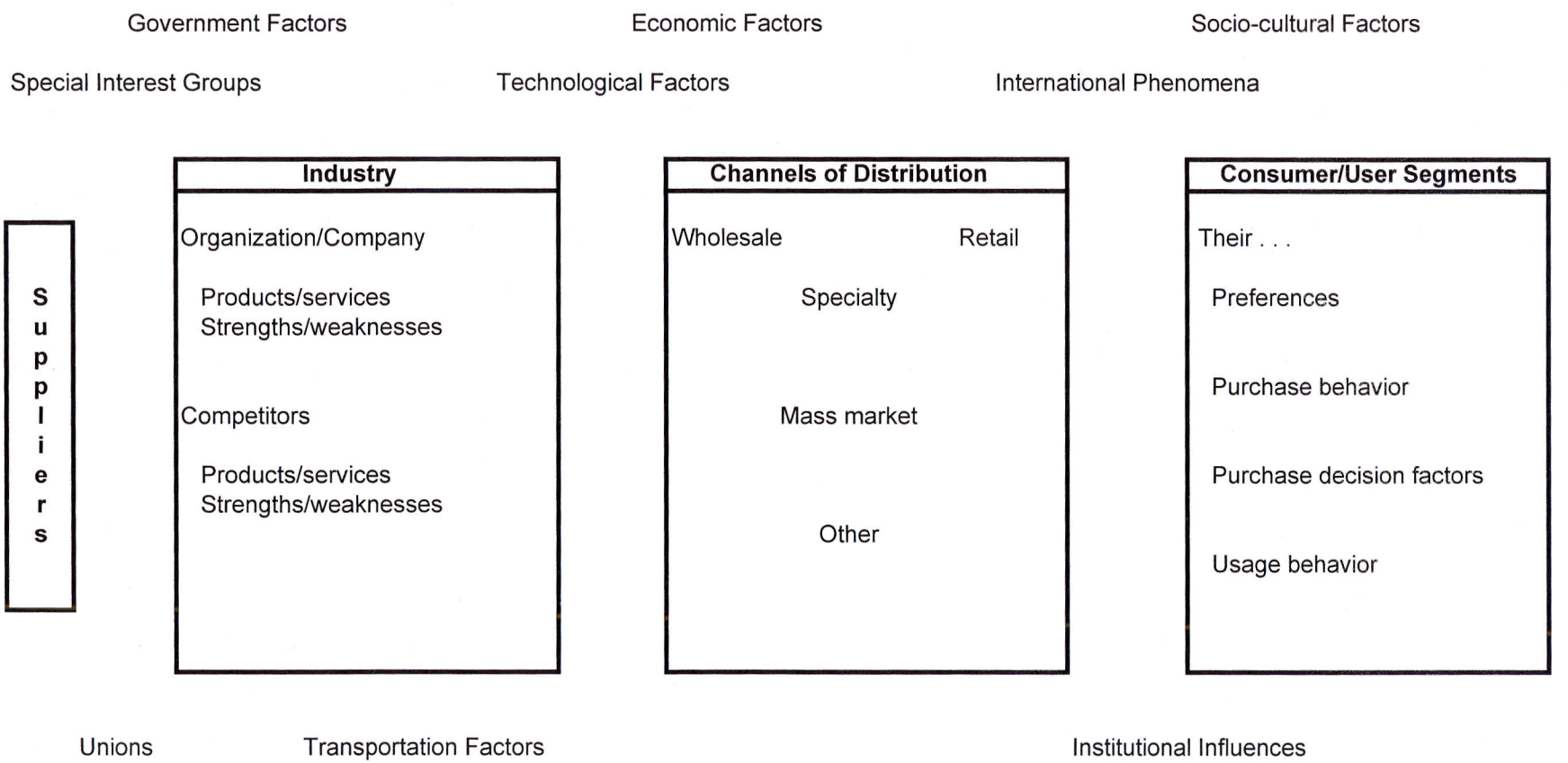
An organization chart provides the best skeletal framework for (1) diagramming/modelling the internal function-related factors and the internal/external socio-technical factors (**Exhibit C**), (2) identifying their interrelationships, and (3) determining what is going on and why. Using this tool together with the two types of checklists is both a science and an art. Although the entire process cannot be fully explained here, we will summarize it and provide basic guidelines, making reference to the simplified example in **Figure 4** on page A-16.

1. Draw a full (or partial) organization chart—preferably on flip-chart paper. Leave at least 5 or 6 inches between jobs at the same level. Leave at least 8 to 10 inches between levels. Also, try to leave about 1 foot of space above, below, and to the sides of the chart. [The seminar-size organizational models we have developed for clients have filled a 20 foot by 8-10 foot space. Participants in our seminars have filled a minimum of two double-wide flip-chart sheets with normal-size printing.]

2. Under each unit name or job title, write in task-related, organizational, individual, and social factors such as these:

major job objectives
major managerial/supervisory tasks
major technical/functional tasks
basic policies/procedures involved
significant material and service inputs
significant informational inputs
equipment/tools utilized
basic knowledge/skills required
functional levels of values, personality traits
basic working conditions
significant characteristics of tasks

Figure 3: Simplified Example of an Industry/Environment Model



managerial/supervisory style
role(s) in social group(s)
significant social norms
basic materials and service outputs
basic informational outputs
job-holder's levels of skills
job-holder's levels of traits
levels of job satisfaction and morale

* Leave several spaces below or to the side of each factor in order to be able to write in the corresponding facts/information. The facts, for example, are: the actual major job objectives and tasks; the actual material, service, and informational inputs; the knowledge and skills required for the job; the levels that are functional for the job; significant values or personality traits and the levels that are functional for the job; the job-holder's actual (or estimated) knowledge and skill levels; and the job-holder's actual (or estimated) levels of specified values and personality traits.

* Where individuals in a unit/group are performing virtually the same job (often at lower organizational levels), it may be appropriate to describe the job once (in terms of task-related factors), and then generalize regarding certain individual and social factors.

3. In the space saved in the upper portion of the model, write in organizational factors such as the following: history/traditions; pervasive managerial/leadership style; formal and informal policies, procedures, and rules; control and information systems; and the general narure of the organizartion.

4. In the spaces above, below, and to the sides of the chart, indicate environmental factors (e.g., economic, marketplace, technological, and sociological factors) that may significantly influence units,specific jobs, and/or particular individuals. Here, too, leave spaces in order to be able to write in the corresponding facts/information.

5. Perform a qualitative analysis of the factors in the model, identifying potentially significant cause/effect relationships among the factors or variables.

   Rather than elaborate on such relationships at this point, we will provide insights into some of the most common cause/effect relationships under Step 7.

6. Add facts/information to the model. Write the facts/information that correspond to each factor in the spaces provided below or to the sides.

7. Analyze the model to determine what is going on and why—that is, which factors are affecting other factors, and how. Especially look for phenomena that are dysfunctional for the attitudes, activities, interactions, and resulting performance of units and individuals, and, therefore, are also dysfunctional for the performance of the organization as a whole.

   Keep in mind that individuals' and group's performance is largely influenced by these general factors: (a) their job satisfaction, motivation, and morale; (b) their knowledge, skills, and experience; (c) the quality and timeliness of the material, service, and informational inputs to their tasks; and (d) the equipment or tools they utilize.

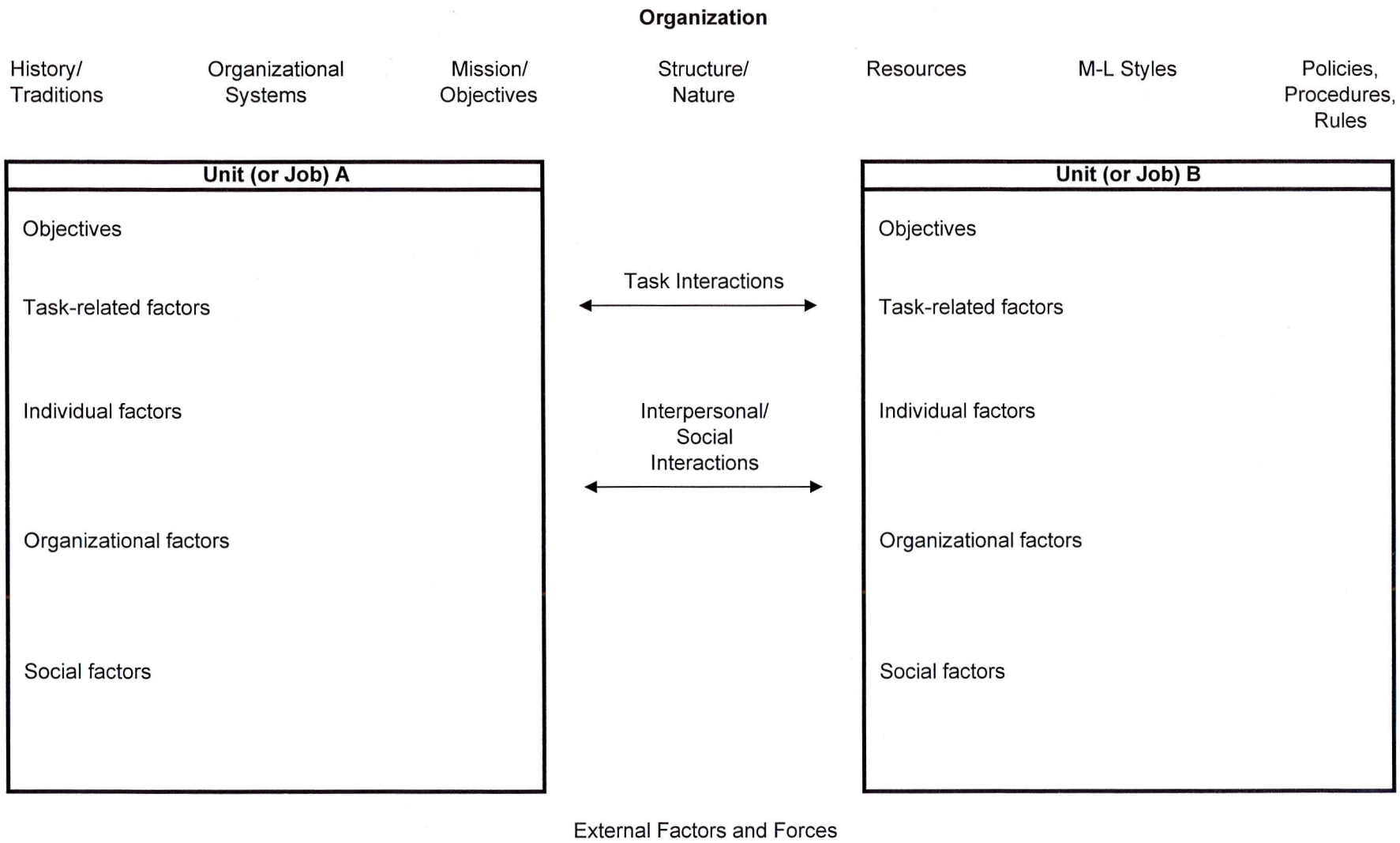
   Draw lines and arrows to indicate significant cause and effect relationships among factors. Circle (or highlight) factors that (a) are apparently causing problems, and (b) can stand some change or improvement for the better.

Answering the following questions will generate insights into a number of the most important cause/effect relationships among socio-technical factors:

a. Are <u>job satisfaction and motivation</u> being adversely affected by any of these task-related, individual, organizational, or social factors?

   1. inadequately defined job objectives, responsibilities, and procedures
   2. unreasonably high performance goals and standards
   3. constant, unexplained, and seemingly senseless or unnecessary changes in policies, procedures, and rules
   4. inadequate or defective equipment/tools

Figure 4: Simplified Example of a Model of Organizational Socio-Technical Factors



5. low quality or untimely material and service inputs
6. incomplete, unreliable, invalid, inaccurate, inappropriately formatted, or untimely informational inputs (inputs that often facilitate/support flows of materials and services)
7. excessive, stress-creating workloads or backlogs
8. inadequate, uncomfortable, undesirable, or unsafe working conditions
9. inadequate capabilities to perform well (and take pleasure and pride in performance)
10. personal values, personality traits, interests, and goals that are incompatible with or dysfunctional for the job
11. personal interests and goals that are incompatible with unit or organizational goals
12. the non-motivating, mechanistic characteristics of routine, mindless, and boring jobs
13. inadequate ego fulfillment through the work itself
14. the absence of management attempts to enrich jobs (make them less mechanistic, more fulfilling, and inherently motivating)
15. inadequate compensation and benefits
16. bosses' authoritarian (directive, controlling, impersonal) managerial/supervisory or leadership styles
17. lack of respect for and trust in superiors
18. receipt of directions/decisions from different, conflicting sources
19. unfulfilling relationships with bosses, colleagues, and/or subordinates
20. social groups' use of positive and negative sanctions to enforce non-task- or non-work-oriented norms (attitudes, expectations, and behavior patterns)
21. disgruntled personnel spreading discontent
22. policies and rules that prevent or discourage social interaction on the job
23. work area arrangements that prevent social interaction
24. interpersonal conflicts with colleagues or co-workers
25. not knowing what is going on—and why
26. apparent management lack of awareness of or concern about these phenomena

b. Are individuals' <u>personal capabilities</u> to perform effectively and efficiently being adversely affected by any of these task-related, individual, or organizational factors?

1. inadequate formal education
2. inadequate job-related technical/functional/professional training
3. inadequate managerial/supervisory training in integrative methods/skills (analytic, planning, problem-solving, decision-making, organizing, staffing, guiding, or controlling skills)
4. inadequate managerial/supervisory training in interpersonal skills (social insight, interpersonal sensitivity, communication skills, and conflict resolution skills)
5. inadequate knowledge concerning interfacing jobs (objectives, tasks, procedures, problems, input needs, etc.)
6. inadequate/dysfunctional job-related policy and procedural guidelines
7. inadequate or defective equipment or tools
8. unavailability, incompleteness, and/or inaccuracy of informational inputs
9. inadequate/dysfunctional organizational policies and procedures regarding staffing (hiring, selecting, promoting)
10. inadequate/dysfunctional organizational policies and procedures regarding orienting and training personnel
11. bosses' dysfunctional attitudes and practices regarding staffing
12. bosses' dysfunctional attitudes and practices regarding orienting and training personnel
13. bosses' lack of coaching and training skills
14. organizational use of ineffective training materials/programs

c. Is any individual's or group's <u>performance</u> also being adversely affected by any of these task-related, organizational, and social factors?

1. lack of (delegated) authority necessary to fulfill certain job responsibilities
2. lack of participation in making decisions affecting the job
3. unchallenging performance goals/standards
4. low quality or untimely materials or services inputs
5. unavailable, incomplete, unreliable, invalid, inaccurate, improperly formatted, or untimely informational inputs
6. inadequate budget/resources allocations (necessary to achieve expected results)
7. inappropriate or ineffective formal structure (which can breed the evolution of equally ineffective informal working relationships)

8. inadequate/dysfunctional vertical integration (planning/coordination) of task activities by superiors, colleagues, and/or subordinates
9. inadequate/dysfunctional horizontal integration (planning/coordination) of task activities by superiors, colleagues, and/or subordinates
10. decisions not being made at the most appropriate levels/positions
11. inadequately defined reporting relationships
12. inappropriate performance evaluation or appraisal parameters
13. inadequate feedback regarding results or performance
14. inadequate information system (that is not getting appropriate information to the right people in the right format at the right times)
15. inadequate communication system (inadequate modes and/or equipment)
16. information being withheld/used by someone to increase status/influence
17. dysfunctional organizational norms/policies/procedures that do not encourage systematic solution of problems
18. managerial/supervisory authority being undermined by a social group's task leader and/or social leader
19. individuals have tendency/need to socialize (and/or waste time in other ways) rather than work
20. conflicts not being confronted and resolved
21. management lack of awareness regarding these phenomena

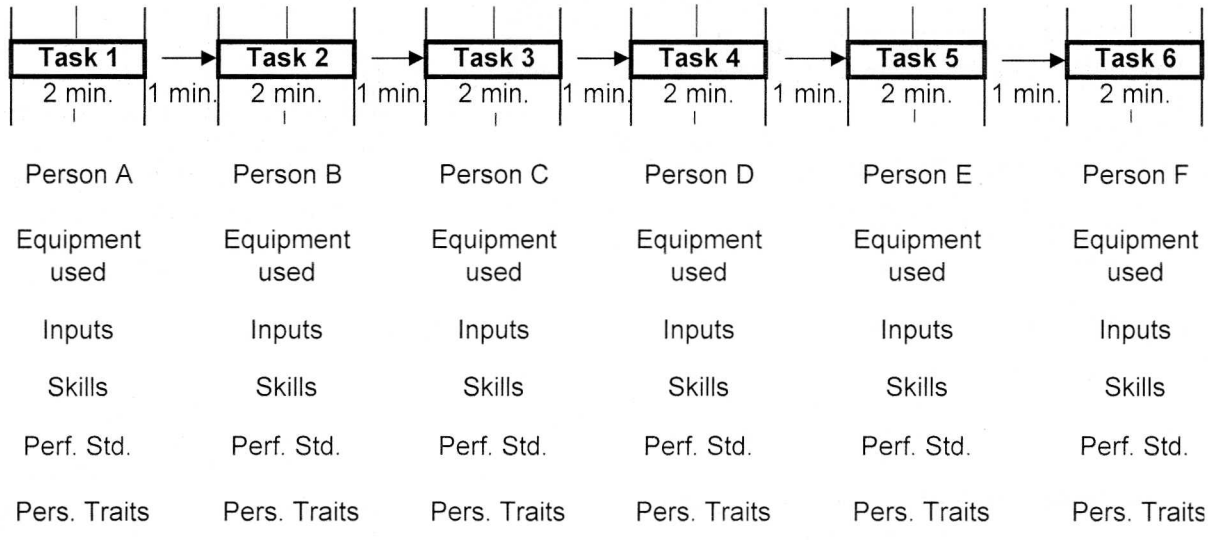
d. Are communication-, interaction-, or performance-decreasing <u>conflicts</u> being bred by any of these task-related, individual, organizational, or social factors (that cannot be blamed on the parties involved)?

1. differences in the time orientations of the parties' jobs (e.g., short term in marketing, intermediate term in production, long term in R&D)
2. differences in the parties' job status (often a function of job titles, organizational levels, education, training, and complexity of skills required)
3. work area layouts that prevent/hamper job-related communication
4. work area layouts that prevent/hamper interpersonal interaction
5. low quality or untimely materials, services, or informational inputs and outputs being exchanged by the parties
6. inadequate communication facilities that hamper job-related and interpersonal communication
7. differences in the parties' levels of interpersonal skills
8. differences in the parties' job-related values, interests, and personality traits
9. inadequate/dysfunctional vertical and/or horizontal integration of task activities by superiors
10. dysfunctional organizational norms/policies that encourage ignoring, denying, or smothering conflicts rather than confronting and resolving them
11. differences in the work-related social norms being adhered to by the parties
12. dysfunctional social group norms that encourage ignoring/denying/smothering conflicts rather than confronting/resolving them
13. competition for group leadership roles within the parties' social groups
14. competition between the parties' social groups (for members, status, etc.)
15. management lack of awareness of or concern about these phenomena

e. Are internal factors being adversely affected by these and other external forces/factors?

1. unavailability of inputs (raw materials, components, or parts)
2. inadequate, inaccurate, or untimely informational inputs from suppliers, customers, service providers, etc.
3. inadequate, ineffective, or inefficient transportation that impedes the flows of (a) inputs from suppliers, or (b) outputs to customers
4. excessive regulation by government agencies
5. unstable markets (significant, frequent, and/or unpredictable changes in market conditions that create uncertainty)
6. changing technologies (significant, frequent, and/or unpredictable changes in production, R&D, marketing, information processing, and other technologies that create uncertainty)
7. changes in markets and/or technologies that make jobs more complex
8. outside groups that adversely affect personnel's attitudes and behavior

Figure 5: Simplified Example of a Time/Activity Line (Diagram)



9. significant adverse changes in normative societal attitudes and behavior (which can negatively affect marketing efforts, public relations, technologies used, etc.)
10. economic phenomena that inhibit sales
11. tight money markets that restrict capital availability
12. high interest rates that increase capital costs

D. **Time/Activity Lines**

Analytic frameworks such as **Figure 5** can consist of a line divided into equal time frames (minutes, hours, days, weeks, months, or even years), with finite tasks —or jobs composed of finite tasks—indicated at the points on the time line at which they occur. In other words, they usually illustrate processes (sequences of tasks over time).

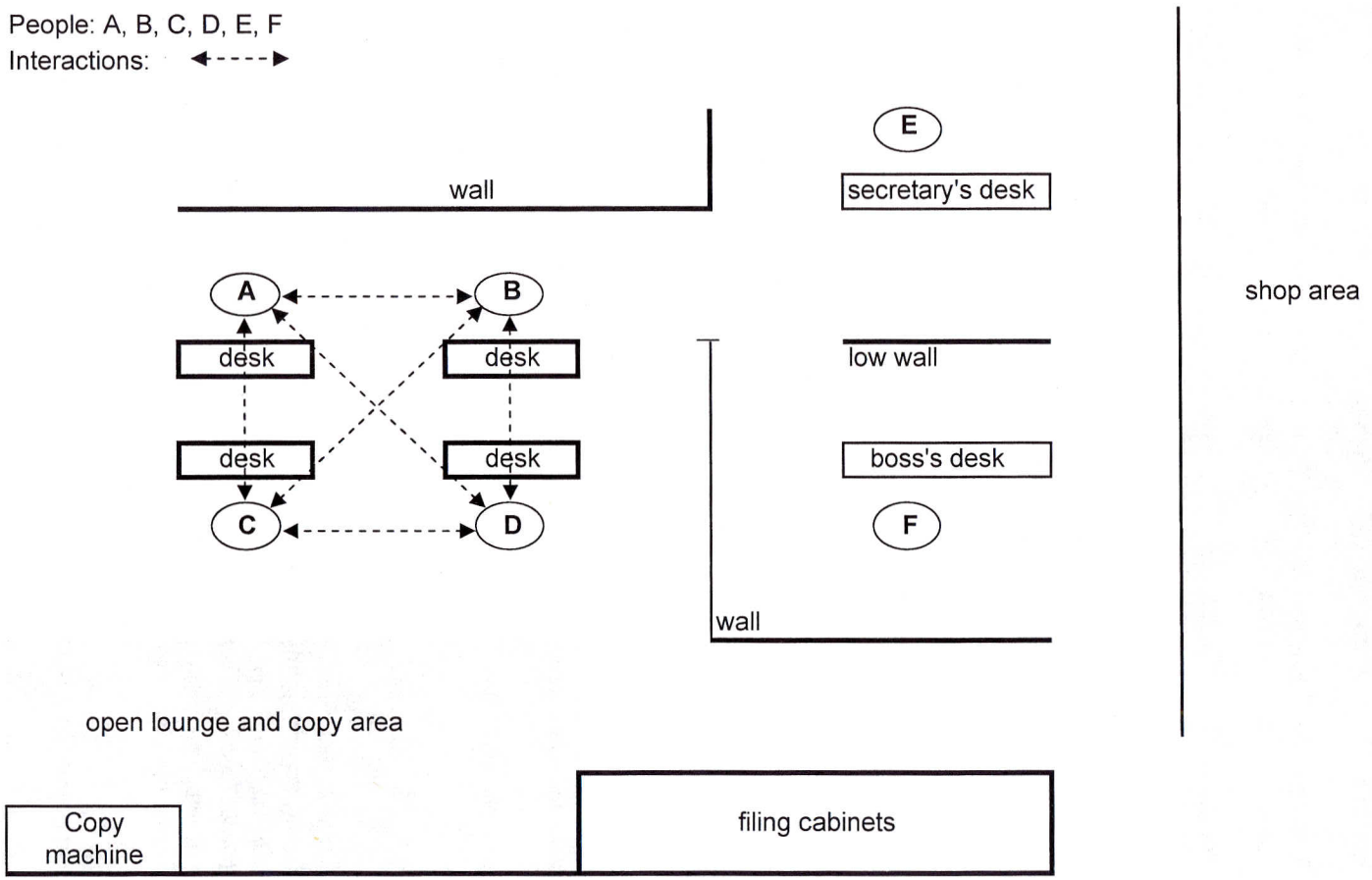
These visual diagrams can be used for several reasons:

a. They can be used to analyze the efficiency of systems or processes involving sequences of task activities and the flows of inputs/outputs between work stations. In fact, they are most often used by engineers to analyze and plan or redesign chemical manufacturing processes and production/assembly lines. Service organizations such as banks and hospitals sometimes use them to analyze and streamline the processing of information concerning customers' and patients' accounts.

b. They can also be used to analyze sequences of tasks for the following purposes:

   1. To rearrange finite tasks into groupings that are less mechanistic (more natural, meaningful, interesting, challenging, and inherently motivating) and more effective and efficient. (In other words, instead of having person A performing task 1, person B performing task 2, person C performing task 3, person D performing task 4, person E performing task 5, and person F performing task 6, it may be more appropriate, for example, to either (a) have persons A through F performing all tasks 1 through 6; or (b) combine some pre-work and post-work tasks so that persons A through C are all performing tasks 1 through 3, and persons D through F are all performing tasks 4 through 6.)

Figure 6: Simplified Example of a Physical Area Model



2. To identify and solve problems that have task-related, individual, organizational, and social causes.

Using a time/activity line for either purpose should involve (a) adding various task-related, individual, organizational, and social factors to the time/activity line framework, and (b) analyzing them in conjunction with the basic information on the line. These are some suggestions for doing what is illustrated in **Figure 5**:

1. When first drawing the time/activity line, (a) leave enough space underneath to write in the task-related, individual, and social factors (and corresponding information) that are indicated beginning at the bottom of page A-13; and (b) leave enough space above to write in organizational factors (and information) that may be influencing attitudes, activities, interactions, and performance.

2. Analyze the system of factors as one would when using an organization chart framework, answering the same types of questions regarding cause and effect relationships among the factors.

E. Physical Area Diagrams

These visual analytic frameworks are essentially floor plans—that is, diagrams of work area layouts. Architects and office managers use them to help plan or redesign the utilization of office space—e.g., the locations of offices, desks, and office equipment; physical boundaries such as walls, doors, and windows; lighting; and personal facilities. Production engineers use them to plan or redesign placement of the following within a production facility: machinery/equipment; workstations; tool rooms; materials handling facilities and areas; and inventory areas.

Physical area diagrams can also be used to analyze the task-related, organizational, individual, and social factors that are operating in a physical setting. For example, they can be very helpful when analyzing (a) flows of materials and services; (b) flows of information; (c) building/office/plant traffic patterns; and (d) office/production machine utilization and bottlenecks. In addition, while organization chart frameworks are helpful for analyzing task-related and interpersonal interactions among organizational units, physical area diagrams are more helpful when attempting to identify how interpersonal/social factors and phenomena are affecting attitudes, interactions, activities, and performance in a particular work area.

The following are basic guidelines for using the type of visual analytic framework shown in **Figure 6**.

a. Use a large enough sheet of paper (e.g., flip-chart paper) so that there is adequate space to . . .

   1. draw a large diagram of the work area;
   2. draw/indicate the locations of objects and people;
   3. write in the factors listed beginning at the bottom of page A-13 (and the corresponding information) either below or beside the individuals' locations; and
   4. write in appropriate organizational and external factors (and associated data) above, below, and to the sides of the diagram.

b. Analyze the system of factors (and corresponding facts/information) as one would when using an organization chart. Ask the same sorts of questions regarding cause and effect relationships among factors. Also ask questions such as these regarding social phenomena:

   1. How are individuals' social and ego needs being influenced by (a) physical proximity to the boss's office; (b) location relative to the coffee table, lavatory, or lounge; and (c) the relative sizes and decor of offices or work spaces? As a result, how are individuals' and social groups' attitudes, activities, interactions, and performance being affected?
   2. Which jobs are interdependent because of materials, services, or information inputs and outputs? Who, therefore, needs to interact with whom for job-related purposes? How frequently must they interact? As a result of (frequent) job-related interaction, who is also able to interact with whom on an interpersonal basis and to form one-on-one or group relationships?
   3. Are individuals able to communicate? Do they have phones or intercoms? Do obstacles such as walls, space partitions, and distance prevent direct verbal communication? Do they prevent visual communication (with facial expressions and gestures)? How are these phenomena affecting people's attitudes, task activities, and social interactions?

4. Which individuals belong to which informal social groups?
5. What are these groups' (unwritten) norms (attitudes and behavioral expectations) regarding matters such as membership, individual and group behavior, the enforcement of norms with positive and negative sanctions, and interaction with outside individuals and groups? Are these norms functional or dysfunctional for members' and outsiders' job-related attitudes, activities, interactions, and performance?
6. How can these groups be influenced? Who are the social groups' task and social leaders, clowns or entertainers, member recruiters, arbitrators, and followers? What task, individual, or organizational factors are responsible for their status and roles?

Methods for Organizing, Arranging, and Displaying Data

Once information corresponding to factors/variables has been researched and gathered, it is generally a disorganized and unmeaningful collection of facts and bits of data. Data, being numerical, is abstract and especially unmeaningful. Therefore, so that data can be analyzed properly, it must first be organized or arranged in some logical manner. Then, so that it can be analyzed insightfully, it must be transferred to, or converted into, some type of meaningful format or display.

Data regarding a factor (and related sub-factors) can be **organized and arranged** in several ways:

A. Data for a single time period is often arranged in descending order of magnitude—from the highest amount (at the top) down to the lowest amount (at the bottom). This is done with factors such as "total sales by region, "total sales by salesperson," and "personal disposable income by state."

B. The above data can also be arranged in alphabetical order by state, city, individual, organization, etc.

C. Strings or series of data (over time) are generally arranged in chronological order—from the oldest data (on the left) to the most recent data (on the right). This is done, for example, with economic data, sales data, cost data, production data, and the financial data in operating statements and balance sheets.

Data can be meaningfully **formatted and displayed** in several ways:

A. Listed: Lists are often used to display data for a main factor and some number of sub-factors for a single time period—as in items (a) and (b) above. The heading or title of the list is generally the main factor—e.g., "total sales by salesperson." In this example, the left column lists the salespersons (sub-factors); the right column displays the sales figure for each salesperson.

B. Mapped: Economic data, demographic data, sales data, and other types of data are often shown on a map in order to facilitate better visual analysis and comparison of data for countries, regions, states, urban areas, sales territories, etc.

C. Modeled: The four types of diagramatic models discussed in the previous section are excellent tools for visually integrating and analyzing industry, environmental, task-related, organizational, individual, and social factors/variables and the facts/ information/data that correspond to them. Single bits of data can be displayed next to the appropriate factors/variables. So can time series of data—if adequate space has been provided. Adding facts/ information/data to an initially qualitative model makes that model more quantitative. It enables both qualitative and quantitative analyses to be performed using the same display. This, in turn, facilitates the identification of relationships among factors/variables. It also facilitates making comparisons among them.

D. Tabularized: Tables (having rows and columns) can be used to display both single bits of data and strings/ series of data. For example: The first table in **Exhibit F** lists various sales-related factors down the left-hand column, and displays the corresponding data for several geographic areas in columns to the right. The second table in **Exhibit F** lists various revenue and cost factors (accounts) down the left-hand column, and displays the figures for four years in columns to the right (as do financial statements, which are almost always columnar tables, but may also have graphs).

Exhibit F: Examples of Tables

1. 1989 Sales of Products "A" and "B" (by Region)

	Eastern Region	Western Region	Total
Product A unit sales	300	400	700
Product B unit sales	330	420	750
Product A dollar sales	$75,000	$100,000	$175,000
Product B dollar sales	$100,000	$125,000	$225,000

2. Product "A" Revenue, Cost, and Gross Margin (1996-2000)

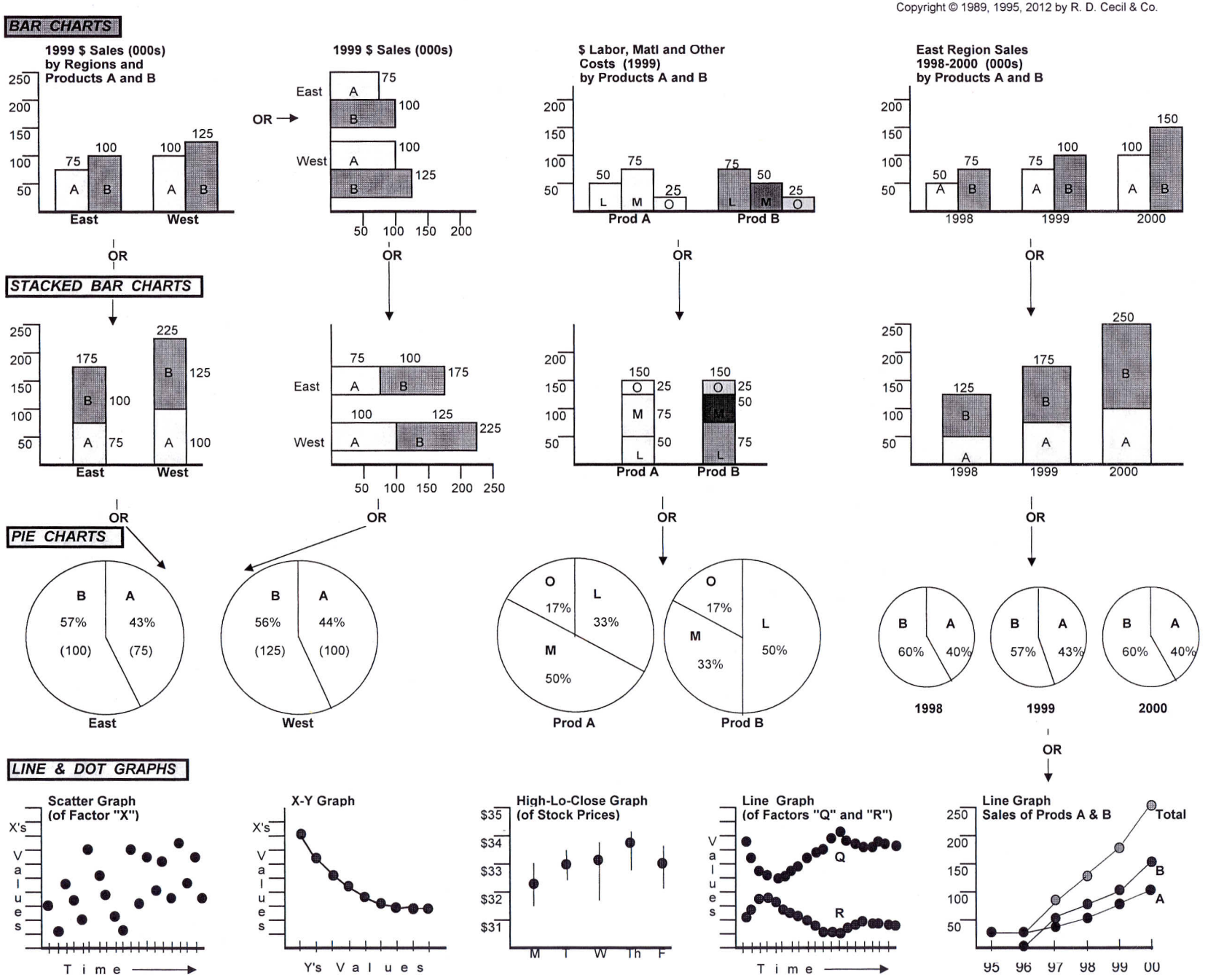
	2010	2011	2012	2013	2014
Unit sales	400	450	550	700	800
Net sales revenue	$90,000	$100,000	$125,000	$175,000	$200,000
Cost of goods sold					
Direct labor cost	18,000	21,150	26,400	35,000	40,800
Indirect labor	3,600	4,050	5,500	7,000	8,800
Materials cost	28,000	31,950	40,150	52,500	61,600
Total COGS	49,600	57,150	72,050	94,500	111,200
Gross profit margin	$40,400	$42,850	$52,950	$80,500	$88,800
GPM as % of sales	45%	43%	42%	46%	44%

E. Charted/Graphed: As shown in **Exhibit G** on the next page, several graphic tools can be used to display data: bar charts; stacked bar charts; pie charts; line graphs; XY graphs; scatter plots; and high-low-close graphs (of stock prices). All of these graphic displays are invaluable analytic tools. They make abstract (numerical) values more (visually) meaningful. Several enable individuals to (a) compare the values of several factors, (b) identify quantitative relationships among variables, (c) identify trends, and/or (d) gauge rates of increases or decreases in factors over time.

1. Bar Charts: These use bars having lengths that indicate the numerical sizes or quantities of one or more variables. As in Exhibit G, the bars can extend either vertically or horizontally along some numerical scale (which can be on either the vertical axis or the horizontal axis). Either single bits of data or time series of data can be shown for one or more factors. These graphic displays enable meaningful visual comparison of both absolute and relative values of factors. They also enable the identification of trends over time (when time series of data have been graphed). Note that bars for different factors are colored or shaded differently so that they can be distinguished from each other more easily.

2. Stacked Bar Charts: These charts are similar to regular bar charts in all the above respects except one. Instead of having bars side by side, they have bars stacked on top of each other. As a result, they can indicate not only total values of factors, but also the values of components or sub-factors that add up to the totals.

Exhibit G: Examples of Charts and Graphs (Graphic Data Displays)



3. Pie Charts: These are much like stacked bar charts in that they indicate the absolute and relative values of factors' totals and the absolute and relative values of components or sub-factors. Here, however, the stacked bars (for components or sub-factors) become wedges or slices of the total pie. Since a pie can only represent a snapshot of data at a particular point in time, several pie charts must be used when time series of data are to be displayed.

4. Line Graphs: These are generally used more often than bar or pie charts to display time series of data. They consist of an "X" (horizontal) axis and a "Y" (vertical) axis. The Y axis is normally the numerical scale (from a low value such as "0" at the bottom, to some high value at the top). The X axis is essentially a time line divided into, for example, years. Lines on the graph are constructed by placing dots at points on the graph to indicate the data for each (year), and then joining the dots with lines. The data for as many as five or six factors/sub-factors can be displayed effectively on a single graph. The second example from the bottom right in **Exhibit G** displays (fictitious) data for long-term and short-term interest rates. The example at the bottom right displays total and component data over time.

   In general, line graphs are more effective tools than bar or pie charts—and are considerably more effective tools than tables or spreadsheets of data—for (a) identifying trends, (b) comparing and relating trends, and (c) visualizing rates of increases or decreases in factors' values.

5. XY Graphs: These are similar to line graphs—except that the values of two or more sets of variables are displayed at the same time. These graphs are used to determine how sets of data correlate or compare (e.g., which factors are independent variables and which are dependent variables).

6. Scatter Plots: Basically, these are XY graphs without lines connecting the dots.

7. High-Low-Close-Open Graphs: These are used to track stock and commodity prices over time and to identify market trends.

At least two questions should be asked when choosing which data format to use: Which displays the data most meaningfully and appropriately? Which is most likely to generate significant or useful insights?

Although lists, tables, maps, charts, and graphs display data differently than visual models, they can and should be used in conjunction with those models during analytic processes. Most of the qualitative and quantitative analytic methods and tools discussed above are fairly basic. Managers, supervisors, and even worker-level personnel should understand them and be capable of using them. By comparison, the techniques and tools discussed below are more advanced and sophisticated. Although they are generally used by experts, managers should at least be aware of and understand them. In general, operations research experts use the analytic methods and tools discussed above in order to develop the tools discussed below.

Operations Research Techniques and Tools

Operations research (OR) has contributed significantly to improving analytic effectiveness and efficiency. Basically, OR techniques and tools are used to model and analyze systems of variables in order to determine (mathematical) relationships among the variables. We discuss these analytic models at this point because they are normally developed during the analysis phase. They are subsequently used during the decision-making phase to analyze, test, play "what if" with, and compare alternatives.

Linear Programming

This is one of the most frequently and widely utilized OR techniques.[7] It can be used to determine either (a) the optimal combination of resources necessary to meet a goal, or (b) how best to allocate limited resources among competing uses in order to maximize benefits and minimize losses.

Underlying the use of LP is the assumption that straight-line relationships exist among variables—i.e., an increase or decrease in one variable brings about a definite, corresponding, or proportional increase or decrease in another. Such relationships tend to exist in production and assembly operations.

Applying the LP technique involves the following steps (which are usually performed by individuals having expertise in systems analysis, statistics/mathematics, and/or computer programming):

a. During the analysis phase, . . .

   1. Identify the significant variables involved 2. in the system.
   2. Determine the existence of linear (or straight-line) relationships between the variables involved by subjecting the data associated with them to linear programming analysis (i.e., mathematical regression analysis).
   3. Express the relationships in mathematical equations.

b. Later, during the decision-making phase, . .

   1. Solve the equations for each alternative under consideration.
   2. Identify the optimal course(s) of action.

The LP approach is often used in manufacturing, warehousing, and shipping situations, where the following conditions normally exist:

a. Systems of activities and inputs/outputs can be engineered into efficient processes.
b. Information concerning resources or inputs (such as materials, materials costs, machine capacity, machine operating costs, floor space, human resources, and labor costs) can be quantified.
c. Outcomes or objectives (such as units of output) can be measured accurately.
d. Linear (straight-line cause/effect or input/output) relationships tend to exist between variables, and the limits of variations in these relationships can be determined.

The applications of LP are numerous and varied. For example, it can be used to . . .

a. determine the optimal production mix (how many of which parts or products to produce);
b. plan feedings or menus so as to maximize nutrition while minimizing costs;
c. determine the most profitable blend of ingredients;
d. optimize production vs. inventory decisions;
e. optimize warehouse utilization;
f. identify the most cost-effective shipping modes, rates, and routes; and
g. determine the most profitable mix of investments over a period of time.

Nonlinear Programming

Because linear relationships do not always exist between variables, newer and more complicated techniques involving nonlinear programming are becoming more widely used.[8] These techniques are similar in principle to, and are basically variations on, linear programming. However, they are aimed at identifying and dealing with relationships among variables that are not linear or straight-line in nature.

In other words, nonlinear programming is usually applied in situations where increasing or decreasing one variable does not necessarily result in a straight-line (commensurate, proportional, arithmetic) increase or decrease in another variable.

Nonlinear programming can be used in conjunction with, for example:

a. media research;
b. promotion analyses;
c. distribution systems analyses; and
d. sales territory analyses.

Queuing Theory

This set of principles also deals with systems of variables. Here, however, activities and inputs/outputs are subject to irregularities that tend to cause "queus" (waiting lines or bottle-necks). Queuing theory involves certain principles of linear programming, but also takes into account the costs of waiting lines.[9]

For example: In many manufacturing and transportation situations, "units" (e.g., materials, vehicles, or people) arrive at some type of service or processing point, are processed or serviced, and then either depart or are forwarded. Queus tend to develop if the service/processing points are not designed or staffed to process/service the units efficiently. The problem: On one hand, waiting lines are costly to the extent that (a) people's performance of tasks is delayed, (b) inefficiencies increase operating costs, and/or (c) customer

disgruntlement results in decreased sales revenues. On the other hand, it is also costly to eliminate queus by adding more people or machines to service/process the units.

Applying queuing theory to situations such as these involves taking these basic steps . . .

1. determining the costs resulting from waiting lines;
2. determining the costs involved in reducing or preventing waiting lines;
3. determining acceptable waiting times; and then
4. using mathematical techniques to balance the costs of waiting lines versus the costs of reducing or preventing waiting lines.

Applications of queuing theory include determining the optimal number of . . .

a. machines (to eliminate production bottlenecks and smooth operations);
b. loading docks and forklifts (to service delivery trucks and to reduce materials handling costs);
c. toll booths (to avoid traffic jams);
d. store checkout counters (to keep customers from waiting);
e. service personnel (to keep customers/clients/patients from waiting); and
f. airport check-in counters, gates, and runways (to speed passenger arrivals and departures).

Information Theory

While linear programming and queuing theory are used to analyze activities and flows of materials and services within a system, this set of principles is used to analyze, evaluate, and improve the flows of information within that system.[10] In order for activities and materials and services flows to be efficient, the right information in the right format must get to the right people at the right times.

Some of the major questions addressed by information theory are:

a. Who needs what information in order to . . (perform what tasks, analyze what situations, or make what decisions)?
b. How will the information be processed or utilized?
c. In what format should the information be provided?
d. When or how frequently is it needed?
e. Who or what are the alternative sources of the information—i.e., who either accumulates it, generates it, and/or maintains it?
f. In what format(s) is the information currently available?
g. What means are available to get the information where it should go?
h. What means should be used to get it there?

Servo Theory

This OR technique is actually a sub-set of information theory. It revolves around the feedback principle, which was originally incorporated into the design of automatic and remotely controlled systems. Information is fed back to control mechanisms, which then correct for deviations or changes in a system.[11]

Servo theory is being applied when, for example, . . .

a. a thermostat feeds back information to a control unit, so it can adjust heating or cooling;
b. information is fed back to analysts, so that they can correct or update analytic/decision-making models; and
c. operating results are reported to managers (and/or supervisors and employess) during the control phase of the management process, so that the data can be analyzed, performance can be evaluated and improved, and problems can be identified and solved.

Symbolic Logic

In this OR approach, symbols are substituted for propositions and even entire programs.[12] This has enabled sharper analysis of complex, abstract, and ambiguous problems.

Simulation (Models)

Operations research emphasizes using quantitative/mathematical models to represent, imitate, or simulate real world conditions and real world interactions

among variables.[13] These models enable testing and comparing alternative courses of action without incurring prohibitive costs and without adversely affecting systems of variables. For example, simulation models are used to test airplane designs in wind tunnels, play war games, train pilots in flight simulators, and predict economic phenomena (using econometric models).

Actually, simulation is involved in most of the OR techniques discussed above. For example: Linear programming involves contructing production- or process-related mathematical models to determine and simulate straight-line relationships among activities and flows of materials. Nonlinear programming involves constructing models to determine and simulate nonlinear relationships among variables. Queuing theory involves developing models that deal with the relationships among variables that are brought about by random occurrences. (In queuing models, random numbers are generated by a computer process called "Monte Carloing.") Game theory (or "gaming"), which is discussed in the section on decision making, involves developing market-oriented models of possible competitive scenarios. More complex simulation models involve using more than one of the various OR techniques.

Simulation models are developed during the analytic phase. During the decision-making phase, they are used to test and evaluate, play "what if" with, and compare alternatives.

Since mathematical models cannot accurately imitate all real world conditions (all variables and their interactions), they are incapable of providing optimal solutions. Nonetheless, they are extremely valuable tools.

Later, in the section on decision making, we will discuss several other operations research techniques and the tools associated with them: value theory, game theory, and probability theory. The tools associated with these three analytic techniques are normally developed/constructed and used during the decision-making phase—not the analysis phase.

Forecasting Techniques/Tools

Many individuals associate forecasting with the planning pPhase. It is true that sales, sales revenues, and costs associated with proposed plans (programs/projects) are forecasted during the budgeting steps of the planning phase. However, during the analysis phase of strategic/long- and short-term planning processes, it is common practice to forecast how economic, technological, political, socio-cultural, and other factors/phenomena may affect (a) industry operations and sales in general, and (b) organizational operations and sales in particular. At this point, therefore, we describe a number of forecasting methods, many of which can be used during the analysis phase.

The three major types of forecasts are: sales forecasts; economic forecasts; and technological forecasts. Economic and technological forecasts generally influence organizations' sales forecasts. Other forecasts—such as political, socio-cultural, and ecological forecasts—are not discussed here, but they can influence economic, technological, and sales forecasts.

Sales Forecasting Methods include the following:

Salesforce observations	The Box-Jenkins Method
The scenario method	The Delphi Technique
Historical analogy	Correlation methods
Test marketing	Leading indicators
Market surveys	Regression analysis

Surveys of customer intentions
Time series methods/models
Jury of executive opinion

During the analysis phase, many of these methods can be used to forecast (a) industry sales, and (b) organizational sales given economic trends and present organizational marketing approaches.

During the budgeting process, a number of these methods can be used to forecast long- or short-term sales (based on proposed alternative programs/projects).

Economic Forecasting Methods, which provide input to sales forecasts, include:

Leading indicators	Econometric models
Regression analysis	Input-output models

These methods are used during the analysis phase of both strategic/long-term) planning and annual (short-term) planning processes.

Technology Forecasting Methods, which provide input to both economic and sales forecasting, include:

Extrapolative models	The Delphi technique
Morphological analysis	Cross-impact analysis

All the above methods and their advantages and disadvantages are briefly described in **Table 2**, which begins on page A-31.

Again, a fairly extensive list of sources of industry and environment data/trends/forecasts is provided in **Exhibit E** on page A-9.

When making forecasts, it is advisable to (a) identify any working assumptions made necessary by the unavailability, absence, incompleteness, or inaccuracy of data; (b) document the available information on which assumptions have been based; and (c) identify anticipated uncertainties, risks, and contingencies.

Decision-Making Criteria

It is during the analysis phase—not the decision-making phase—that decision-making criteria or evaluation parameters are identified and selected. (Identifying/selecting these criteria is the last step of the analysis phase.) Later, during the decision-making phase, they will be used to evaluate, compare, and choose among the alternative plans or solutions formulated during the planning phase.

Decision-making criteria/parameters are basically characteristics (traits/factors) that reflect needs, wants, or concerns regarding alternatives. They are used as bases, standards, or "yardsticks" for . . .

a. identifying and evaluating the advantages and disadvantages of each alternative's anticipated outcomes/results/consequences;
b. comparing alternative plans'/solutions' anticipated outcomes/results/consequences; and
c. choosing among alternatives—that is, making a decision as to which alternative(s), if implemented, would be most likely to maximize results and/or minimize negative consequences.

In general, decision-making criteria should be those parameters that are associated with key or critical factors affecting an organization's, plan's, project's, solution's, unit's, group's, or individual's success. Examples are: the (highest) resulting profitability; the (least) cost; the (shortest) time span to results; the (highest) return on investment; the (least) disruption of operations; and the (shortest) payback period. (It is because key or critical factors of success are being identified and analyzed during the analysis phase that it is most appropriate to select decision-making criteria during this phase.)

Some of these criteria may be stated as hurdles, constraints, or minimum standards that must be overcome/met.

> *Examples*: "To be chosen, an alternative . . . cannot cost more than $X; must have a payback period no longer than X years; or cannot involve incurring debt any greater than $Y."

Many commonly used criteria are listed in **Exhibit H** on the next page. It should be pointed out that there are more specific sets of criteria for evaluating and comparing alternatives involving, for example, facilities sites, new product possibilities, and particular R&D, financial, marketing, or production situations.

The criteria in Exhibit H have different characteristics and uses:

a. Certain criteria are more quantitative or objective (numerical in nature, tangible and subject to measurement), while others are more qualitative or subjective (non-numerical, intangible and difficult to measure and evaluate).

b. Some are mostly used to evaluate and compare alternative sets of long- and short-term goals/plans, some are mostly used to evaluate and compare alternative capital projects, some are mostly used to evaluate and compare alternative solutions to problems, and many are used for all three purposes. (See the booklet on decision making.)

When selecting criteria, some may be identified as "musts/needs," while others may be identified as "wants" or "nice to haves."

In general, at least four or five criteria should be selected in order to take account of major considerations. Ten to twelve are usually sufficient, but more may be used when considered necessary.

Exhibit H: Examples of Commonly Used Decision-Making Criteria/Parameters

QUANTITATIVE / OBJECTIVE

- Profitability
  - Total revenues
  - Total operating costs
  - Cost savings
- Growth
- Return on investment (ROI)
- Total capital expenditure
  - Installation costs
  - Start-up costs
- Retained earnings used
- Debt incurred
- Debt expense
- Resources conserved
- Market position
  - Unit sales
  - Market share
- Productivity
  - Productive capacity
  - Utilization of capacity
- Time span to completion
- Time span to results
- Time span of commitment
- Time span to reach volume
- Contribution
- Profit break-even point
- Sales break-even point
- Payback period
- Net present value (NPV)
- Accounting rate of return (ARR)
- Profitability index (#)
- Benefit/cost ratio
- Internal rate of return (IRR)
- Overall expected terminal value
- Liquidity
- Working capital
- Debt/equity ratio
- Inventory turnover (rate)
- Net worth
- Earnings per share (EPS)
- Stock price

QUALITATIVE / SUBJECTIVE

- Probability of success
- Certainty of results
- Compatibility w/ other goals/plans
- Ease of implementation
- Degree of change involved
- Complication of current operations
- Disruption of current operations
- Flexibility (to modify plan)
- Reversibility of action
- Control of results
- Precedent being set
- Competitiveness
- Diversification
- Financial stability
- Technological innovation
- Product/service quality
- Product/service innovation
- Effects on other products
- Ability to service (customers)
- Product life cycle (obsolescence)
- Availability of parts/materials
- R&D know-how
- Production know-how
- Marketing know-how
- Legal acceptability
- Patentability (legal protection)
- Environmental effects
- Safety
- Managerial development
- Organizational development
- Vulnerability to . . .
  - Economic phenomena
    - Business cycles
    - Seasonality of demand
  - Technological change
  - Competitive responses
  - Supply sources
  - Governmental intervention
  - Union opposition
- Impact on personnel:
  - Employee welfare
  - Employee job satisfaction
  - Employee performance
- Resulting relationships with . . .
  - Suppliers
  - Customers
  - Employees/union
  - Community
  - Regulatory agencies

Table 2: Forecasting Methods

	(+) Advantages / (-) Disadvantages
Qualitative/Judgmental Sales Forecasting Methods	
Sales Force Observations: This involves obtaining the views of salespersons and sales managers concerning the sales outlook for individual products, product groups, and/or total sales. This is often a "bottom up" approach, wherein estimates of sales (of product groups) are aggregated.	+ Is inexpensive. + Takes account of judgmental factors and experience where historical data may not be available or applicable. - Susceptible to biases of individuals in the salesforce.
Survey of Customer (Purchasing) Intentions: This method provides useful insights and perspectives on the future of the business.	+ Enables early identification of changes. - Use is difficult when customers are numerous. - Customers do not always do what they say.
Naive Extrapolation: This method involves applying basic assumptions about economic events during the next time period, or simply extending the results of current events—perhaps subjectively.	+ Is inexpensive. + Can obtain results quickly. + Can update projections responsively/frequently. - Can be problems handling wide fluctuations.
Scenario Methods: These involve formulating smoothly unfolding narratives that describe an assumed future expressed as a sequence of time frames or snapshots.	+ Can adapt readily to changes/shifts. + Can reflect changes/shifts well. + Requires little quantitative/ADP capabilities. - Urgency can seriously compromise accuracy.
Jury of Executive Opinion: This involves combining/averaging top executives' views regarding the item to be forecast. Participants usually include marketing/sales, production, finance, purchasing, and staff personnel in order to get the benefit of diverse experience and opinions. Staff groups often provide background data to the executive group. (Salesforce forecasts, survey results, and expert opinion could all be inputs to this method.)	+ No usage of elaborate statistics makes forecasting quick and easy. + Can reflect internal/external changes well. + Can reflect internal/external changes quickly. - Forecasts often made without benefit of much useful information and many needed insights (can be more subjective than objective).
Historical Analogy: This method involves basing predictions on past events that are analogous to the present situation.	+ If data is readily available, is inexpensive. - Can only crudely reflect changes/shifts. - Forecast quality can vary substantially.
Expert Opinion (Delphi Technique): This involves hiring outside experts such as consultants, professors, or research firms to forecast sales. Working by themselves, they base their forecasts on their studies of the industry and the variables that affect its sales.	+ Eliminates need for meetings, and therefore reduces interpersonal problems and timidity. + Enables careful and thorough analysis. - Experts are generally expensive. - Results are only as good as the "experts." - Does not use or develop in-house expertise.
Quantitative Sales Forecasting Methods	
Test Marketing: This method is often used to forecast the sales of a new product or service in various geographic markets. It is aimed at determining the effects of different prices, advertising themes, and promotional campaigns on sales.	+ Provides useful data when no historical data. + Provides □what if□ data. - Does not account for other factors that may influence sales (of a new/changed product). - May not handle changes/shifts well. - Can tip off competition to market moves.

	(+) Advantages / (-) Disadvantages
Market Surveys (of Attitudes/Behavior): Here, two methods can be used to determine consumers' consumption and purchasing patterns: (a) consumer market surveys; and (b) industrial market surveys (which may render more knowledgeable, accurate information). Information is used to identify trends and forecast sales.	+ Can reflect changes/shifts well. + Provide useful marketing data and insights. - Updates usually done at long intervals, so significant changes may not be identified early. - Effectiveness largely depends on survey design and interpretation.
Time Series (Extrapolative) Methods/Models	
Weighted/Moving Averages (simple extrapolation): Especially where sales follow a fairly stable trend, this method is often used to forecast (monthly) sales in the next time period. For example: Sales for the most recent period(s) (e.g., three months) are weighted more heavily than sales for prior periods, and the resulting trend is extrapolated into the future period.	+ Is easy and inexpensive method to use. + Can update forecasts easily. - Does not necessarily account for many complex influences on consumers' purchasing patterns. - Cannot validly reflect changes/shifts (variable lags always exist). - Cannot anticipate turning points.
Indexing: Index numbers are commonly used to provide a basis for anticipating short-term fluctuations caused by seasonal or cyclical patterns. (Seasonal indices are often projected to determine how sales might be distributed by month of the year.) Index numbers can be determined by simply looking at the ratio of sales for a given month to annual sales for each of the past several years. To make forecasts, companies often use government index (adjustment) numbers (which it uses to make seasonal/cyclical adjustments in economic variables).	+ Is rather easy to use. + Can be used with other statistical methods. + Government index numbers are quite accurate. - Index numbers based on historical data may not accurately represent changing future conditions. - Indexing by itself does not account for possible causes of changes in current conditions.
Exponential Smoothing: This more sophisticated method involves two basic steps: (1) identifying a pattern respresenting a combination of trend, seasonal, and cyclical factors (based on historical data for that variable); and (2) using exponential smoothing and weighted moving averages to smooth the patterns (eliminate effects of random fluctuations) and to extrapolate into the future.	+ Provides results quickly, rather inexpensively. + Takes account of recent events/conditions. + Enables easy updating. + Is more complex than some methods. o Is most accurate for short-term forecasts. - Does not anticipate possible/impending changes. - Does not indicate causal relationships among factors underlying the data.
Adaptive Filtering: This involves deriving a weighted combination of actual and estimated outcomes, and systematically altering them to reflect data pattern changes.	+ Once programed, can produce forecasts quickly. + Deals well with changes/shifts in variables. - Requires the use of a computer. - Is moderately expensive to develop program.
Time Series Extrapolation: This method predicts outcomes based on the future extention of a least squares function fitted to a data series (which uses time as an independent variable).	+ Provides quick forecast if input data available. + Is relatively inexpensive if data available. + Is accurate on strong trends, stationary series. - Cannot validly reflect changes/shifts.
Time Series Decomposition: Here, a forecast of expected outcomes is based on trend, season-al, cyclical, and random components, which are isolated from various data series.	+ Can update forecasts quickly and easily. + Can isolate and determine components' effects. - Is moderately expensive to develop/modify. - Cannot validly predict changes, turning points.

	(+) Advantages / (-) Disadvantages
Box-Jenkins Method: This computerized iterative method produces an autoregressive, integrated moving average model, adjusts for seasonal and trend factors, estimates appropriate weighting parameters, tests the model, and repeats the cycle as apppropriate.	+ Can handle wide range of time series patterns. + Is very accurate for short and medium terms. - Models are expensive to develop and modify. - Usage requires a computer and advanced skills.

Quantitative/Causal Models for Sales Forecasting

Correlation Methods: These predict outcomes based on historic patterns of statistically determined co-variation between variables.	+ Can easily update and adapt to turning points. - Predictive accuracy can vary widely (can be insensitive to changes and shifts).
Leading Indicators: Here, forecasts are based on the predicted values of one or more variables whose values statistically lead (precede), and relate systematically to, the variable to be forecasted.	+ Effective for forecasting cyclical changes. + Can easily update and adjust for patterns. - Can be insensitive to changes (if use inappropriate indicators). - Usually only moderately accurate.
Regression Analysis: Also called "statistical demand analysis," this method assumes that the variable to be forecasted (the dependent variable) can be predicted on the basis of the (predicted) values of one or more independent variables. (Thus, these models can be "uni-variate" or "multi-variate.") (For example, company sales might be seen as being dependent on disposable income, interest rates, and the sales of other industries.) Regression analysis is a statistical technique that fits the specified model to available historical data.	+ Models are more sophisticated and accurate than many of the previously discussed methods. + If causal relationships are stable, can predict turning points and can handle changes and fluctuations well. o Accuracy and sensitivity depend on choice of predictor variables. - Usage requires a computer and much statistical expertise.
Econometric Models: These multi-variate models use a system of simultaneous regression equations that take into account interdendent relationships among various segments of the economy and/or areas of corporate activity. Companies quite often incorporate the results of national or regional econometric models into their own planning models. Although useful for forecasting, these models are also used to answer "what if" questions involving the possible impact of changes in the industry and economy.	+ These deal with more causal macroeconomic and microeconomic variables than other models. + The ability to play "what if" is very desirable. o Accuracy and sensitivity to changes depend on choice of variables. - Usage requires a high degree of economic, statistical, and analytic expertise. - Developing models and acquiring input data is expensive. - Accuracy can vary in dynamic environments. - Usually confined to giving aggregate forecasts.
Input-Output Models: These ("matrix") models simulate relationships between the output of any given industry and the amounts of inputs it receives. They indicate how demand changes in one industry directly affect other industries. They take into account technologies, scale of production, and materials inputs for the economy. (Thus, they, too, are multi-variate models). Such models are most frequently used by various levels of government to evaluate policy alternatives. They are also used by some corporations to forecast industry-wide sales potentials.	+ Provide useful data and insights. + Can be modified to reflect changes. o Sensitivity to changes and shifts depends upon choice of variables/indicators. - Are very expensive to develop and use. - Usage requires a computer and great knowledge and analytic expertise.

Methods for Forecasting Technological Factors	**(+) Advantages / (-) Disadvantages**
Extrapolative Models: These models forecast a variable solely on the basis of historical values for the same variable. Compared to sales extrapolation, time horizons are generally longer and data points are fewer.	+ Using this method is better than using none. - Users must have knowledge of several scientific and engineering disciplines. - The "S curves" in use (for fitting technological data) all produce very different forecasts.
Morphological Analysis: This method involves developing a matrix of all possible technological ap-proaches and the product configurations that might be created. Known products are first indicated on the matrix; then, untried yet desirable possibilities are identified.	+ Usage stimulates technical creativity. - Cannot forecast the properties of a new product or when it will be marketed.
Delphi Technique: Again, this technique is aimed at formulating a reliable consensus from a group of experts concerning future (technological) trends or events.	+ Reduces psychological/interpersonal problems. - Requires the knowledge and analytic ability of outside experts.
Cross-Impact Analysis: This method also involves the use of experts (and can be used together with the Delphi Technique). First, the experts establish a list of future developments of interest. Second, they arrange the developments onto a matrix. Third, they address this question: If any one event occurs, what will be its impact on each of the others? Fourth, concusions are entered into the cells on the matrix. The matrix now indicates that a given event may accelerate or delay another event.	+ Provides many useful insights that are especially useful to companies involved with a number of high-level technologies. - Conclusions are only as good as the experts.

Analyzing -- References

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