



## Controlling



*Dr. Sam C. M. Hui*

Department of Mechanical Engineering  
The University of Hong Kong

E-mail: cmhui@hku.hk

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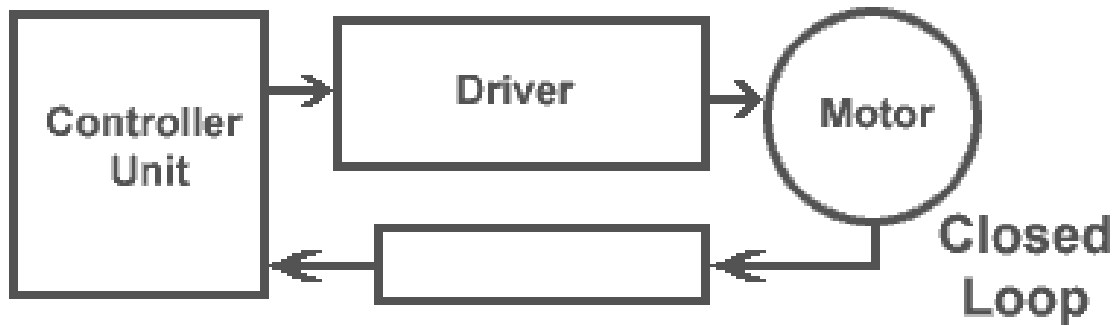


- The Nature of Control
- Controlling Function
- Performance Control
- Financial Controls
- Non-Financial Controls



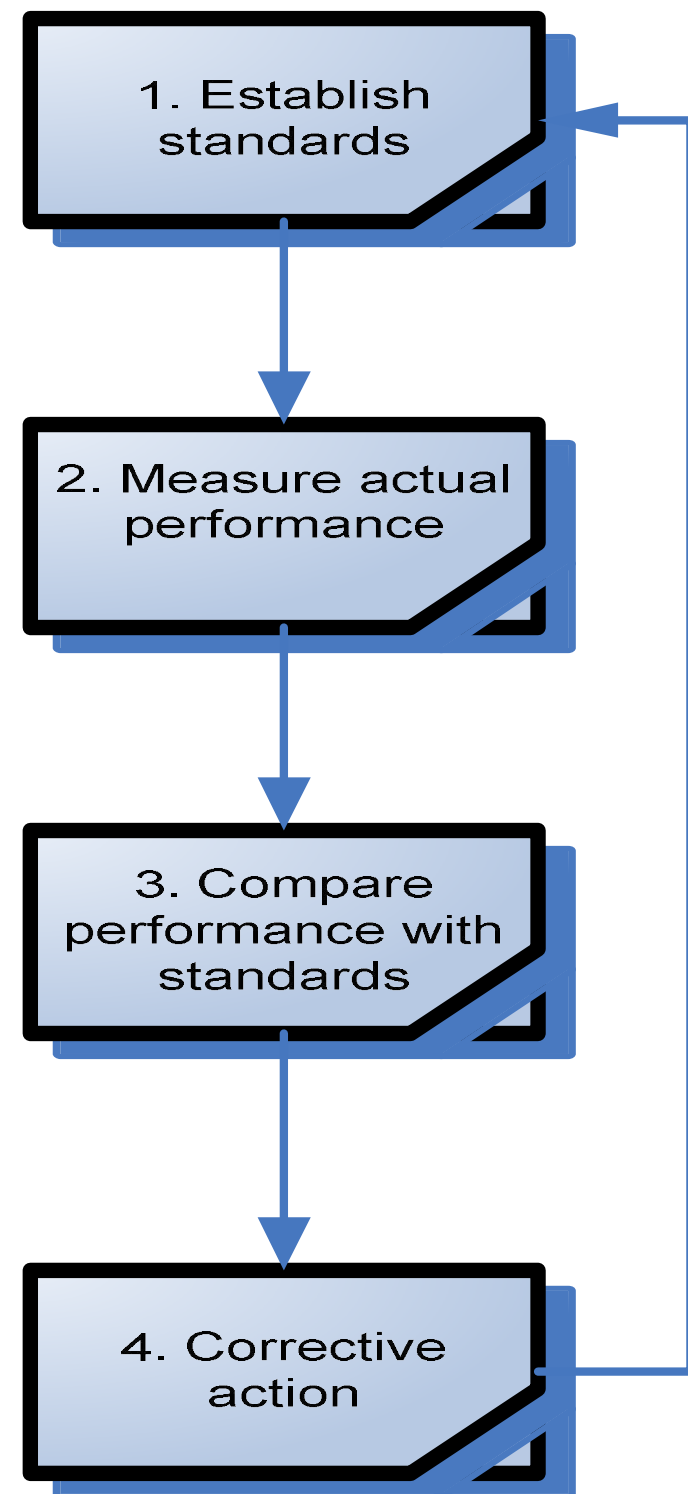
# The Nature of Control

- Controlling definition
  - “Compelling events to conform to plans”
- Control: Closed Loop vs. Open Loop
  - Open Loop
    - Requires external monitoring or agent to activate control
    - Example: Cruise control on an automobile
  - Closed Loop
    - Automatic or cybernetic
    - Monitors or manages process by internal, self-regulating system
    - Essential feature is strong feedback system
    - Example: Home thermostat system



## Feedback Control

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# The Nature of Control

- Characteristics of effective control systems
  - Effective
  - Efficient
  - Timely
  - Flexible
  - Understandable
  - Tailored
  - Highlight deviations
  - Lead to corrective actions





# The Nature of Control

- Controlling
  - Work done by managers to assess and regulate work in progress and to evaluate results obtained, for purpose of
    - (1) Securing and maintain maximum productivity, and
    - (2) Reducing and preventing unacceptable performance
- Nature of controlling function
  - Primarily administrative and operational in nature
  - Critical to implementation of any plan (task, project, program) - no implementation, no results regardless of plan's merits



# The Nature of Control

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- Nature of controlling function (cont'd)
  - Important to delegation - no effective control, no delegation
  - Important to company renewal (pruning)
  - Balance between operational efficiency and staff creativity and innovation
  - Types of control - Output-based and Process-based
  - Resistance to control - falsifying data, inventing excuses, sabotaging, playing games, and pitching one against the other

# Characteristics of good control

- Accuracy
- Timeliness
- Flexibility
- Cost-effectiveness
- Understandability
- Realistic
- Acceptable to those who will enforce decisions
- Control at all levels
- Balance between objectivity and subjectivity

**Pareto Principle**: (the 80-20 rule; the law of vital few)

Principle of Critical Few: 20% of factors affecting 80% of Results - Control the few

(see also <http://www.gassner.co.il/pareto/>)





# The Nature of Control

- Controlling the organization



- Controlling, or coordinating, the organization's systems, processes and structures to reach effectively and efficiently the goals and objectives
- This includes ongoing collection of feedback, and monitoring and adjustment of systems, processes and structures accordingly
- Examples include use of financial controls, policies and procedures, performance management processes, measures to avoid risks etc.



# The Nature of Control

- Integrating / Implementation

- Very hectic job
- Integrate the jobs of groups/ individuals
- Consider and fix responsibilities of defects/ shortcomings
- Manager should be impartial



- Monitoring / Measuring

- Monitor continuously
  - Costs, salaries, expenses & capitals and compare them with budget
- Use of specialized and skilled tools and equipment
- Time scale measurements; measure quality



# Controlling Function



- Controlling as a process
  - 1. Setting the standards
    - Establishing standards to measure performance
    - Financial goal, custom service-related goal and production goal
  - 2. Measuring performance
    - Measuring actual performance
    - Employee performance appraisal
  - 3. Evaluating performance
    - Comparing performance with the standard
  - 4. Controlling performance
    - Taking corrective action

# Controlling Function

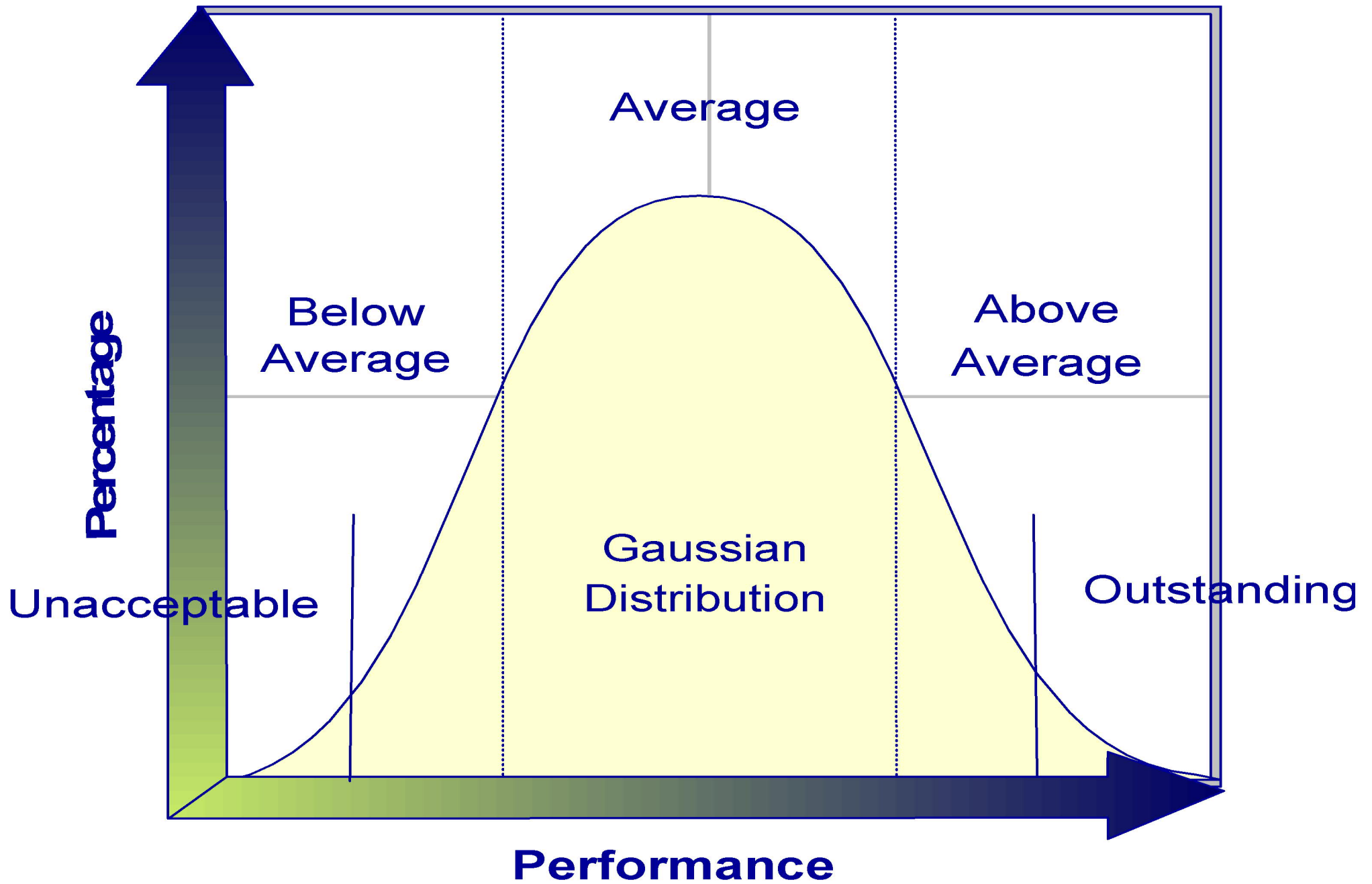


- 1. Setting standards

- Standards are criteria by which work and results are measured and evaluated at grades:
  - a) Average -- generally expected performance level for a given job
  - b) Other grades -- outstanding, better than average, average, below average and unacceptable
- To distinguish performance grades and to define expected impact of results



# Grades of performance



# Controlling Function



- Value of setting standards
  - Provide specific guidelines for exercising authority and making decisions (rewards and punishments)
  - Define yardstick to measure performance (individuals, group/unit, project)
  - Facilitate self evaluation, improvement and self-control
- Types of standards
  - Technical Standards (product first pass success rate, product unit cost, mean time between failure (MTBF) for equipment, hurtle rate, sales per employee, etc.)

# Controlling Function



- Types of standards (Cont'd)
  - Historical Standards (own metrics in the past - internal benchmarking)
  - Planning Standards (cost leadership target, sales revenue, profitability)
  - Market Standards (market share, time to market, earning per share (EPS), order processing cost, customer inquiry response time - external benchmarking)
  - Other Standards (occupational safety & health, environmental quality, energy efficiency, ISO certification, self-imposed performance metrics)

# Controlling Function



- Good standards
  - Based on approved plans
  - Measurable
  - Considerate of human factors
  - Comparable and reasonable
  - Indicative of expected work performance





# Controlling Function



- Barriers to setting good standards
  - Subjectivity - Technically strong managers tend to set unrealistically high standards
    - (1) Too high standards – demoralizing
    - (2) Too low standards - not challenging enough
  - Fearful of not meeting standards
  - Lack of Consideration - Human factors and other considerations

# Controlling Function



- Benchmarking\*
  - Benchmarking is a method of defining performance standards in relation to a set of references

**Internal Benchmarking**

**External Benchmarking**

**How do I compare with myself over the years**

**How do I compare with my peers in industry**

# Controlling Function



- Internal benchmarking
  - Compare current year performance metrics with those in past years to indicate performance improvement (annual reports)
  - Short-term goal setting based on internal benchmarking may create a false sense of corporate wellbeing - absent external benchmarking
- External benchmarking
  - Compare company's performance with those of peers in the same industry
    - (1) Financial ratios

# Controlling Function

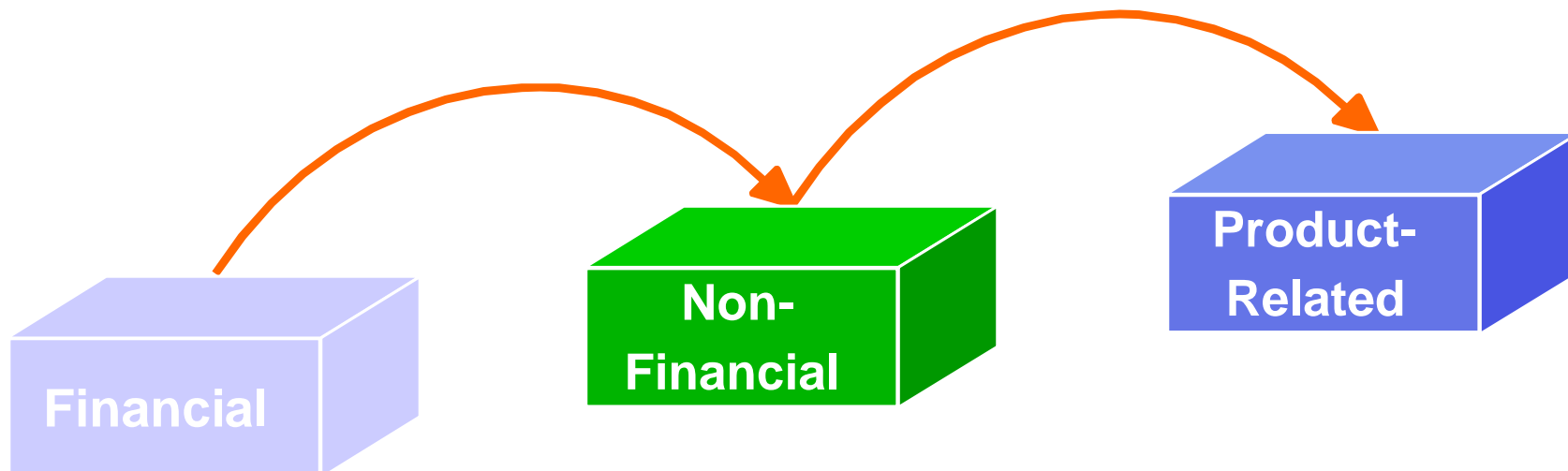


- External benchmarking (cont'd)
  - (2) Performance metrics - Time to market, order processing efficiency, quality control, unit product cost, etc.
  - (3) Best practices - tried-and-true methods of achieving useful results
  - (4) Critical success factors - conditions for achieving success in specific areas based on accumulated learning
  - (5) Target pricing - surveying marketplace to define going prices for competitive products, subtracting desirable margin and setting product cost target for product development - “Innovation under duress” model generally applicable to many business/engineering activities
  - (6) Balanced scorecard – forward looking and non-financial versus past orientation of financial metrics only

# Controlling Function



- Examples of benchmarking metrics
  - Financial Ratios: ROI (return on investment), ROA (return on assets), ROS (return on sales), debt to equity ratio, inventory turns, number of units produced per employee, number of units produced per hour, sales per employees, profit per unit, breakeven volume



# Controlling Function



- 2. Measuring performance

- Collect, store, analyze and record work being done and results attained systematically (progress reports, project reports, technical documents, presentations, staff meeting minutes, personal meeting notes, etc.)
- Compare performance against established standards
- Document results of measurement



# Controlling Function



- 3. Evaluating performance

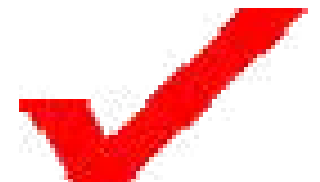
- Appraise work in progress or completed and provide feedback by:
  - (a) Establishing limits of tolerance
  - (b) Note variations - deviation within the tolerance limits, and exceptions - deviation outside the tolerance limits
  - (c) Provide recognition to good performance (give credit timely)
- Focus on deviation tends to encourage self-appraisal/control and foster initiative



# Controlling Function



- 4. Controlling/Correcting performance
  - Rectify and improve work being done and results obtained
    - Taking steps:
      - (1) Correct mistakes and focus on future development
      - (2) Take operation actions - get help from outside consultants, add temp people
      - (3) Take management action - add training, improve procedures and policies to avoid repeating deficiencies, transfer and recommend dismissal

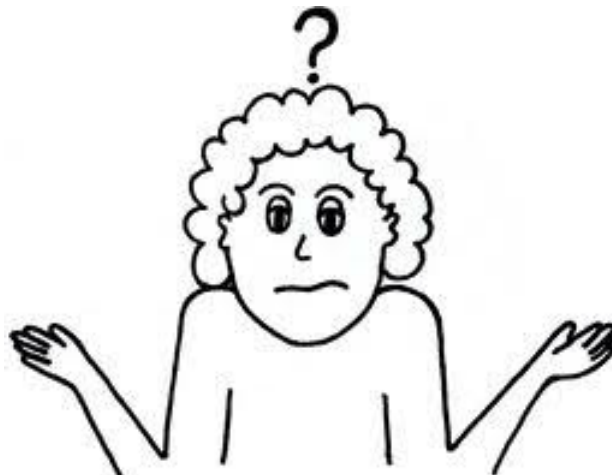




# Performance Control



- Reasons for performance deficiencies
  - Don't Know - Lack definition of performance standards, lack of feedback
  - Can't Do - Lack skills and/or aptitude
  - Don't Care - Lack the proper work attitude



# Performance Control



- Constructive criticisms
  - Negative feedback must be offered carefully to avoid attacking people's esteem
  - Focus on results/outcome, not on person
  - Avoid upsetting people by using “labels”
  - Have no punitive motive and avoid causing pain
  - Show helpful and sincere attitude
  - Provide no threat



# Performance Control



- Some rules of thumb
  - Not good to make mistakes in engineering fundamentals
  - Okay to fail once in a while in new risky development work, but failure in every other projects will hurt own reputation
  - Making the same mistakes again and again (human relations, aggressiveness, poor teamwork attitude) is perceived negatively

# Performance Control



- Means of performance control
  - Personal Review - Focusing on variance - management by exception for decision making
  - Resources - Allocation of capital, people, staff support, technology, equipment/ facilities
  - Project Approval - Initiate, modify or terminate specific project activities

# Performance Control

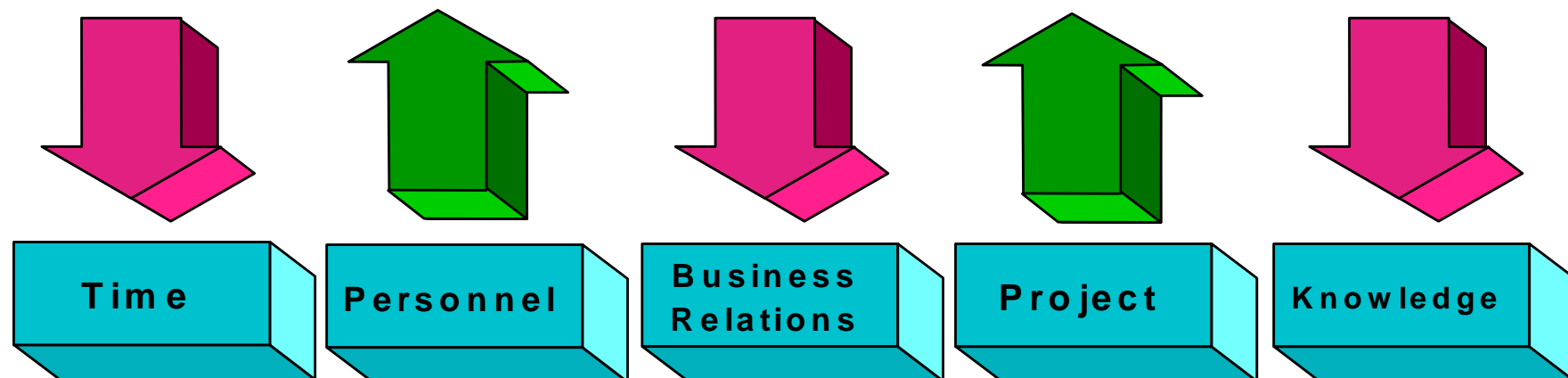


- Guidelines for effective control
  - Focus on location where actions take place
  - Induce self-imposed control (most effective)
  - Avoid extensive control, which tends to demotivate people and induce strong reactions
  - Manage exceptions, both bad and good
  - Strive for flexible and coordinated control (supply information with control mechanism in place)

# Performance Control



- Specific controlling targets
  - (1) Managerial time
  - (2) Personnel
  - (3) Business relationship
  - (4) Project
  - (5) Knowledge

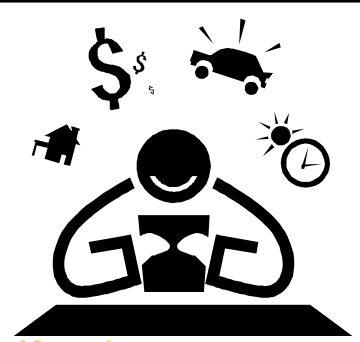


# Performance Control



- Control of management time
  - Important tasks often arrive at unpredictable times
  - Trivial tasks often take up a disproportionately large amount of time
  - Interruptions to manager's schedule are common
  - Typical time wasters
    - Absence of clear roles and responsibilities - overlapping responsibilities
    - Poor self-discipline - No planning, lack of personal drive to accomplish, confused priority, procrastination
    - Lack of effective delegation - trying to do all by self
    - Poor communications - unprepared meetings, policies, politics

# Performance Control



- Tips to manage time
  - Set goals (for the day, week, month, year)
  - Prioritize tasks (classify into A, B and C categories) according to value addition
  - Plan tasks properly
  - Minimize interruptions for blocks of time to do A-tasks - (planning, strategy development)
  - Make use of waiting time
  - Keep reports concise and readable

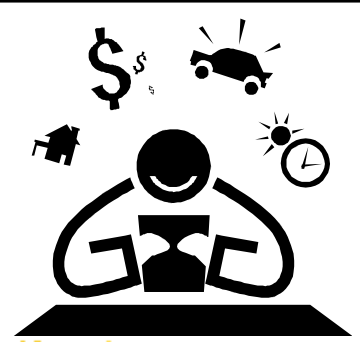




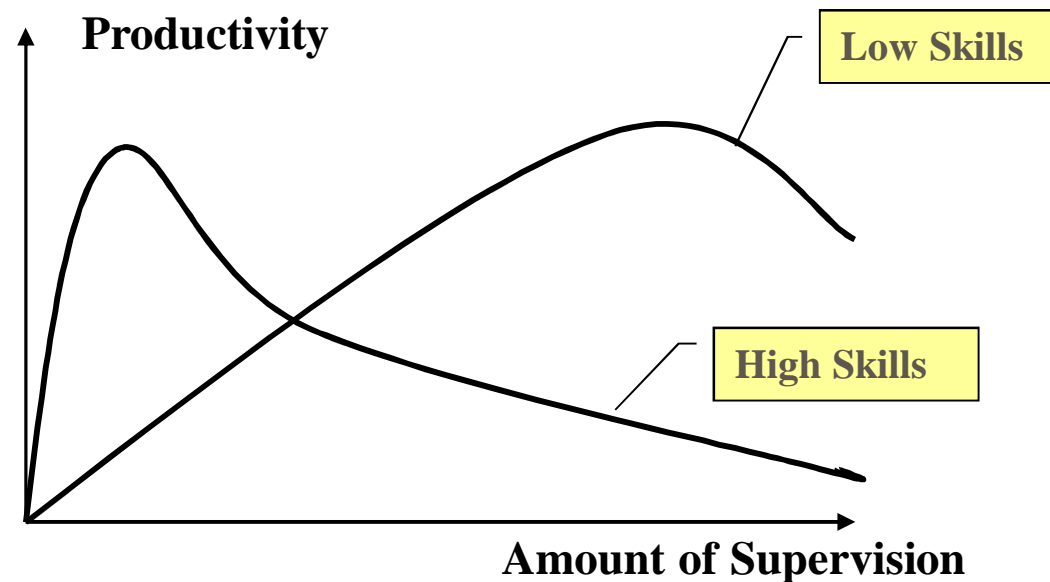
# Time saving tips for engineering managers

<b>1. Set Goals</b>	Write specific, measurable outcomes you want to achieve in the next week, month, year and five years. Consider your work, relationships, play, and well being. Go from goals to plan to work.
<b>2. Use a Master "to-do" List</b>	Categorize all of your "to do" ideas according to which goal each serves. Estimate all others.
<b>3. Get the Big Picture</b>	Plan your priorities so you work foremost on whatever gives you the biggest payoff and potential
<b>4. Cluster Common Tasks</b>	Do similar tasks in the same time block (e.g., a bunch of letters, a bunch of phone calls, etc.)
<b>5. Create Systems</b>	Keep tools, forms, checklists, and information handy and organized for repetitive tasks.
<b>6. Establish Place Habit</b>	Keep everything in its pre-determined place.
<b>7. Delineate Time Blocks</b>	Schedule blocks of un-interruptible time (2-4 hours) to work on projects requiring concentration. Assure colleagues of availability otherwise.
<b>8. Design Your Environment</b>	Make your setting conducive to concentration (e.g., sit with your back to traffic passing your office, and screen calls).
<b>9. Cut Meeting Time</b>	Use proven meeting time-savers (e.g., go to other's offices for meetings, do stand-up meetings, set agenda and follow through rigorously).
<b>10. Reduce Panic</b>	Handle what worries you the most. Ask yourself, "Will this matter seem urgent 10 years from now?"
<b>11. Take the One-Minute Test</b>	Periodically take a minute to ask yourself, "Am I doing this in the best way to meet my goals, serve others, and take care of myself?"

# Performance Control



- Control of personnel
  - For high skills personnel, less control is more desirable, excess control could induce adverse reactions -  
Supervision Curve



# Performance Control



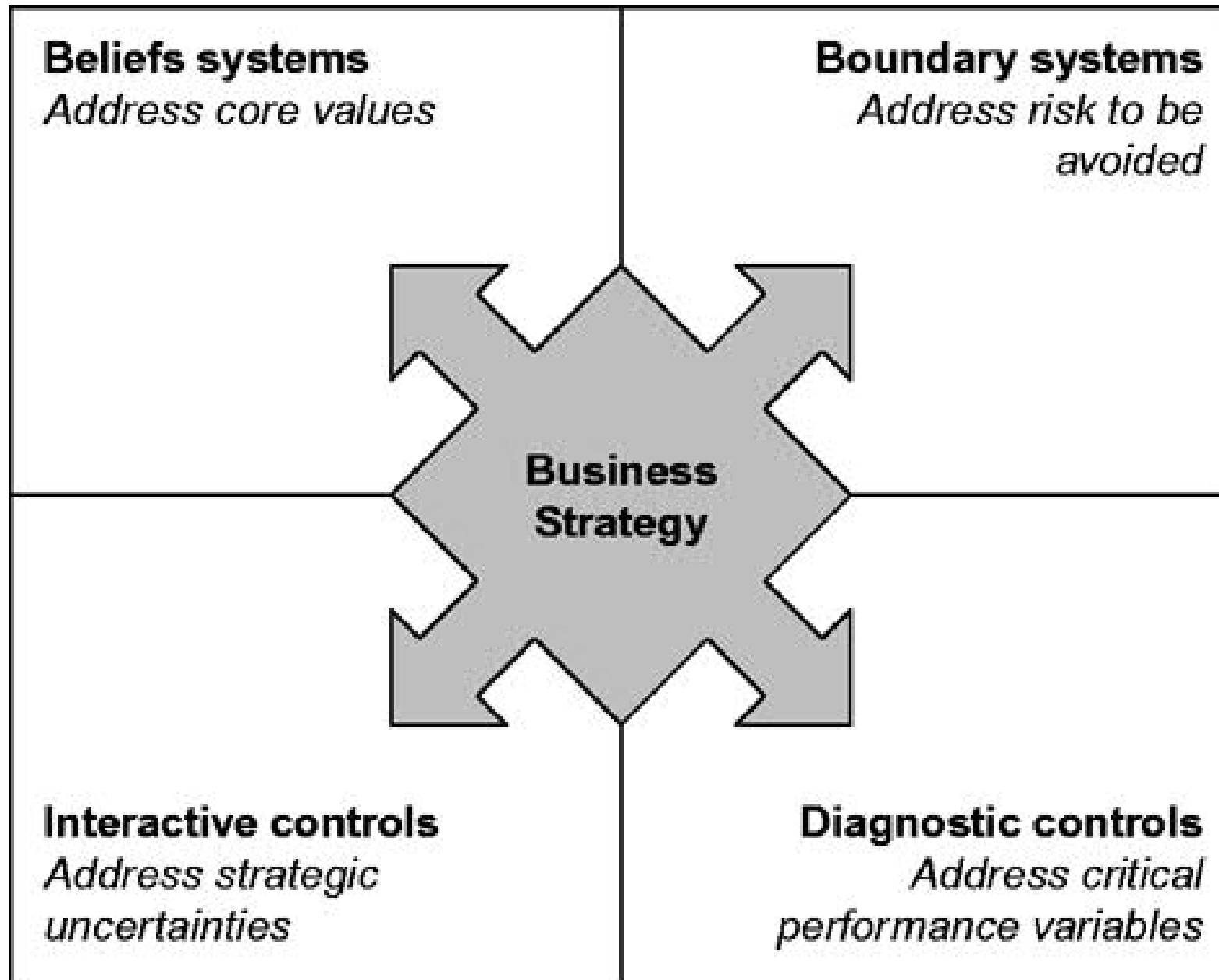
- Skills for managing projects
  - Organizational and planning skills
  - People management
  - Problem solving
  - Communications (team members, sponsors, customers)
  - Drive and energy
  - Goal orientation and customer focus
  - Broad multidisciplinary technical knowledge
  - Manage changes

# Performance Control



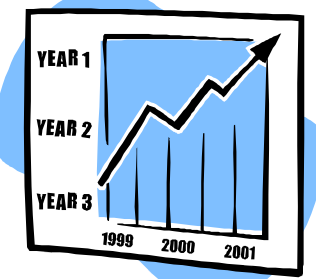
- Controlling
  - Administrative function, with strategic implication (assure implementation, support delegation, foster corporate renewal)
- Set standards using external benchmarking to avoid losing competitiveness
- Correcting poor performance may be unpleasant
- Apply “Four Levers of Control”\*
  - Assure operational efficiency and enhance creativity

# Simons' four levers of control model



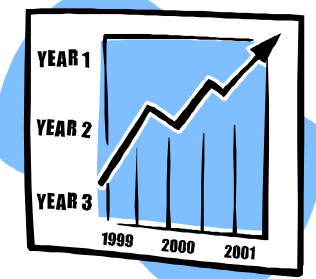
**Source:** Adapted from Simons (1995)

# Financial Controls



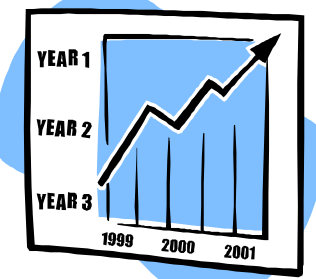
- Terms
  - Budgets are the plans for the future allocation and use of resources over a fixed period of time
  - Income Statement shows financial performance of a firm over period of time. Also called a profit and loss statement
  - Cash Flow shows where funds come from and what they are used for
  - Balance Sheet shows firm's financial position at a particular instant in time
  - Assets are what the company owns
  - Liabilities are what the company owes

# Financial Controls



- Financial Budgets:
  - Identify sources of cash & intended uses
    - Cash Budgets
    - Capital Expenditure Budgets
    - Balance Sheet Budget
- Budget preparation
  - Top Management
    - Estimates of future sales and production
    - Priorities used to meet new objectives
  - Middle Management
    - Prepares proposed revenue and expense budgets designed to attain estimated sales/production levels

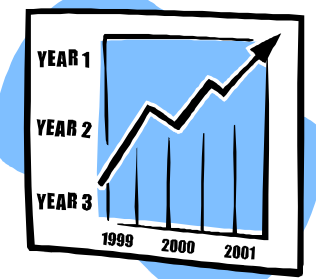
# Financial Controls



- Three major statements
  - Balance sheet
    - Shows the firm's financial position at a particular instant in time
    - Assets and liabilities
  - Income statement
    - Shows financial performance of a firm over a period of time
  - Cash flow
    - Shows where cash comes from and what it is used for



# Financial Controls



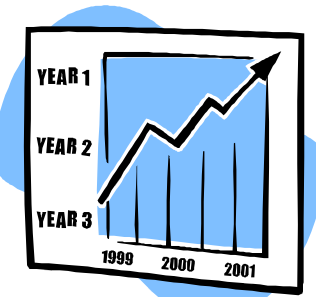
- Balance sheet

- Quickly get handle on financial strength of company
- Includes assets, liabilities, and stockholders' equity
- Assets – Anything business owns that has monetary value
- Liabilities – Claims of creditors vs assets of the business

- Income statement

- Also called Profit and Loss (P&L) Statement
- Most used business report
- Snapshot of money as it flows through business over specific period of time
- Basic formula – revenues-expenses = income/profit

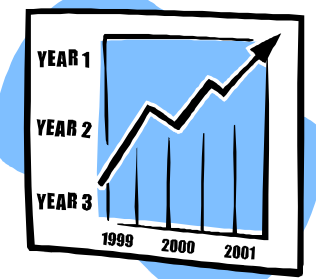
# Financial Controls



- Ratio analysis\*

- Ratios of two financial numbers taken from financial statements (the balance sheet and/or the income statement) and compared to industry averages
- Four types:-
  - Liquidity: Measures ability to meet short term obligations
  - Leverage: Measures the level of debt in a firm's financial structure
  - Activity: Measures how effectively a firm uses its resources
  - Profitability: Measures profit producing performance of firm

# Financial Controls



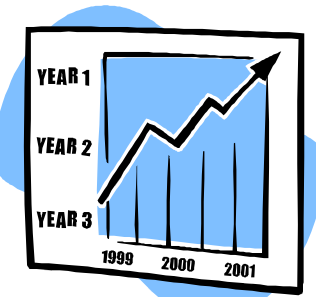
- Liquidity ratio

- Current ratio is formula referred to
- Current assets/current liabilities
- Numbers from Balance sheet
- Acid test ratio

- Profitability ratio

- Net income/Net sales  
From Profit and Loss Statement

# Financial Controls



- Responsibility centers
  - Cost centers
    - Manager's primary concern is control of costs
  - Revenue center
    - Manager's primary concern is attaining revenue target
  - Profit center
    - Manager has more freedom to manipulate costs to increase profit
- Audits of financial data
  - Verify accuracy of firm's financial data
  - May be internal or external
  - Internal audits also evaluate organizational efficiency



# Non-Financial Controls

- Non-financial controls
  - Management audits
    - Evaluate efficiency
  - Human resources accounting
    - Quantifies the value of human resources investment
      - Costs of recruiting
      - Costs of training
      - Costs of process improvement
    - Social controls
      - Standards
      - Comparison with outcomes
      - Corrective action



# Non-Financial Controls

- Non-financial controls (cont'd)
  - Effectiveness of research activities
  - Systems for release of drawing release
  - Inventory control
  - Quality control

# Management audit worksheet for administrative activities

Organizational Effectiveness Review Administrative Factors Worksheet		Administrative Factors Worksheet	
Factor	Rating	Current Strengths, Weaknesses, Needs	Future Objectives and Plans
<p>Planning. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Develop realistic, time-phased plans for the long, medium, and short term?</li> <li>-Analyze risks and provide for contingencies?</li> <li>-Integrate plans and objectives with interfacing organizations?</li> <li>-Produce valid and timely proposals and accurate cost estimates?</li> <li>-Forecast funding and labor requirements accurately?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		
<p>Organizing and staffing. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Establish clear definitions of function, authority, and accountability?</li> <li>-Select the most qualified personnel to fill its needs?</li> <li>-Assign personnel so as to best utilize their capabilities and potential?</li> <li>-Assess its strengths and weaknesses and promptly correct deficiencies?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		
<p>Directing. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Maintain high performance standards?</li> <li>-Stress people-oriented leadership and the importance of personal example?</li> <li>-Delegate work effectively, encouraging maximum employee involvement and responsibility?</li> <li>-Recognize achievement and distribute rewards equitably?</li> <li>-Encourage employee development and growth?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		
<p>Control. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Monitor operational progress and promptly correct deficiencies?</li> <li>-Control expenditures as required to assure achievement of profit objectives?</li> <li>-Adhere to schedules?</li> <li>-Assess its productivity and continually strive to improve it?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		
<p>Communication. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Maintain good intra- and interorganizational communications?</li> <li>-Keep management informed of key operations and problems?</li> <li>-Keep employees informed and solicit their ideas and opinions?</li> <li>-Encourage the exchange of technical information?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		
<p>Procurement/subcontracting. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Act promptly on procurement matters?</li> <li>-Establish effective time-phased plans for procurement?</li> <li>-Assume an active role in "make or buy" decisions?</li> <li>-Assist in developing subcontract sources?</li> <li>-Ensure an adequate definition of work on all subcontracted efforts?</li> <li>-Maintain an effective interface with subcontractors and monitor subcontractor progress?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		
<p>Space and Facilities. <i>Does the organization:</i></p> <ul style="list-style-type: none"> <li>-Accurately predict its space and facilities needs?</li> <li>-Make optimal use of available space and facilities?</li> <li>-Ensure proper maintenance and calibration of all instruments and equipment?</li> <li>-Maintain required accountability records of all property?</li> <li>-Maintain high standards of housekeeping?</li> </ul>	<input type="checkbox"/> -High <input type="checkbox"/> -Avg. <input type="checkbox"/> -Low		

(Source: Morse, L. C. and Babcock, D. L., 2010. *Managing Engineering and Technology*, 5th ed.)

# Further Reading



- Controlling in Organizations (video and texts)
  - <http://education-portal.com/academy/topic/controlling.html>
  - Controlling as a Function of Management (12:30)
  - Financial Controls in Organizations (12:27)
  - Budget Controls: Top-Down, Bottom-Up, Zero-Based & Flexible Budgeting (10:10)
  - Human Resource Controls: Appraisals, Discipline, Observations & Training (10:26)