Functions of Technology Management

PLANNING AND FORECASTING

Preview

Planning can make a difference between the success or failure of an organization.
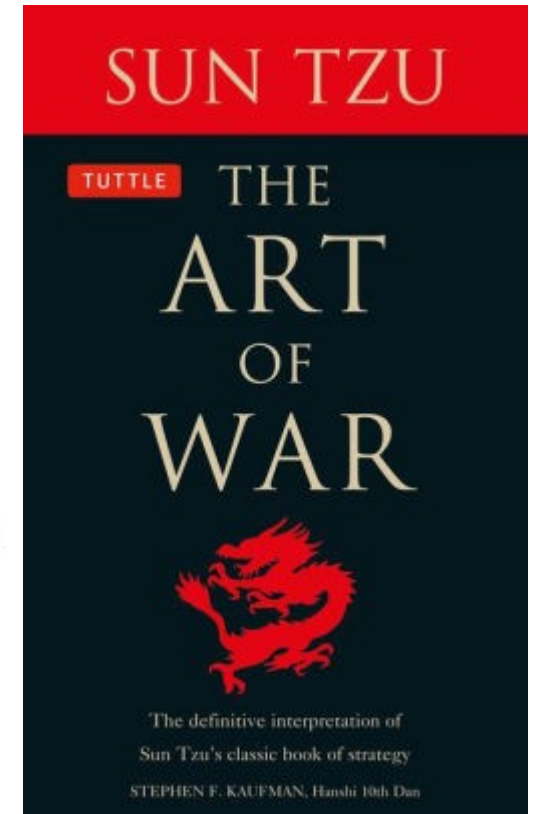
Strategic planning has become more important to the engineering manager because technology, competition, and ongoing changes have made the business environment less stable and less predictable.

Strategic planning provides a road map to help your business get from where you are now to where you want to be.

Nature of Planning

Importance of Planning

"The general who wins the battle makes many calculations in his temple before the battle is fought. The general who loses makes but few calculations beforehand."

SUN TZU

TUTTLE

THE ART OF WAR

The definitive interpretation of Sun Tzu's classic book of strategy

STEPHEN F. KAUFMAN, Hanshi 10th Dan

Planning provides method for identifying objectives and designing a sequence of programs and activities to achieve objectives.

Amos and Sarchet define planning as deciding in advance what to do, how to do it, when to do it, and who is to do it.

" GIVE ME SIX HOURS TO CHOP DOWN A TREE AND I WILL SPEND THE FIRST FOUR SHARPENING THE AXE.

-ABRAHAM LINCOLN

Planning involves

- Defining the organization's goals
- Establishing the overall strategy for achieving these goals
- Developing a set of procedures to integrate and coordinate actions

Planning is concerned with both ends (what is to be done) and means (how it is to be done)

Purpose of Planning

1. Establishes coordinated effort that gives direction to managers and non-managers.

2. Reduces uncertainty by forcing managers to look ahead and anticipate change, consider the impact of change and develop appropriate responses.

3. Reduces overlapping and wasteful activities

4. Establishes goals or standards that are used in controlling.

The Planning/Decision Making Process
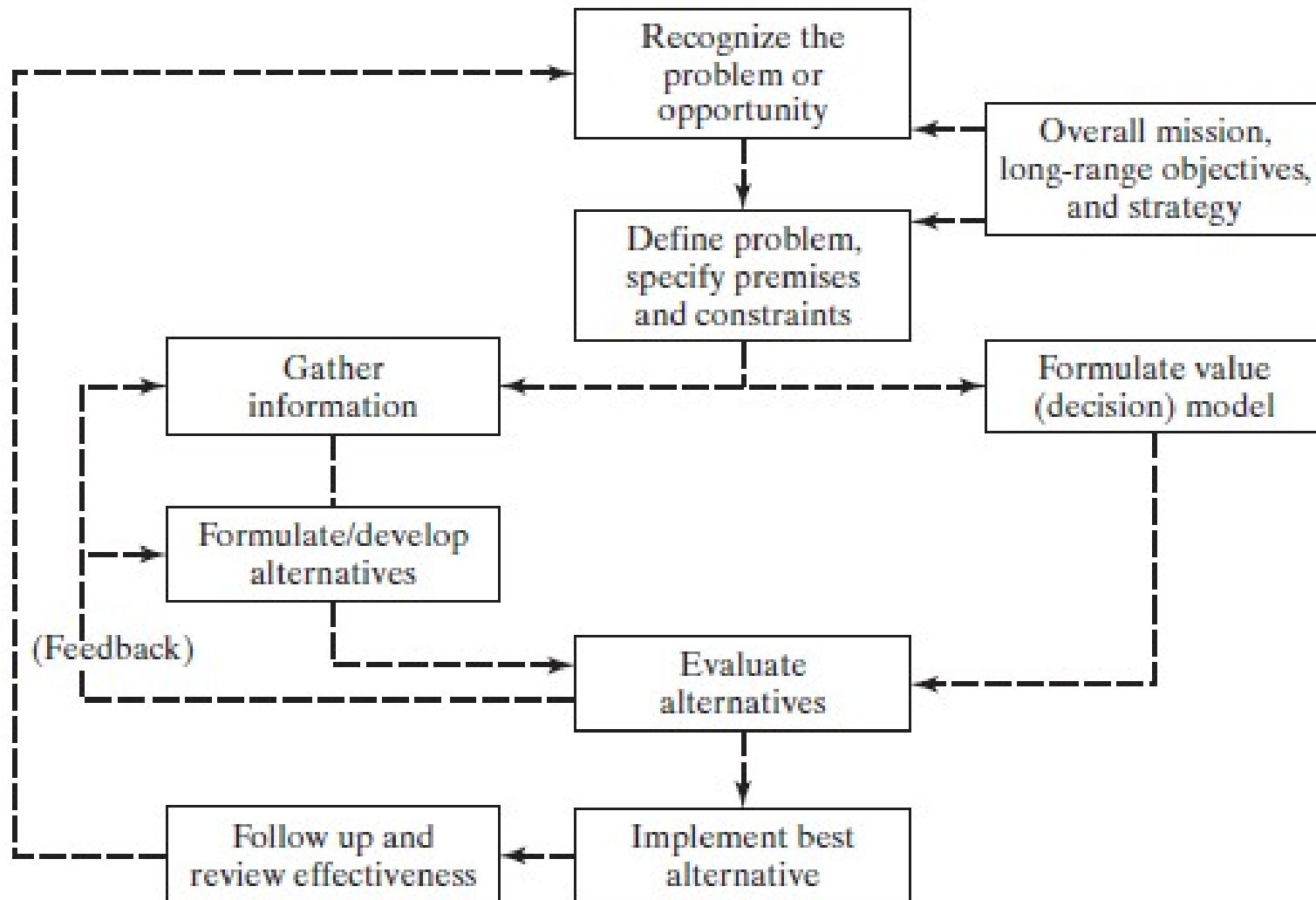
Types of Planning

Breadth	Time Frame	Frequency of Use

Strategic
- apply to whole organization
-establishes organizations overall goals
- mostly done at higher management level

Operational
- how overall goals are met
- mostly middle and lower management level is involved
-covers short term period even day to day actions

Long-term

- time frame of more than 3 years
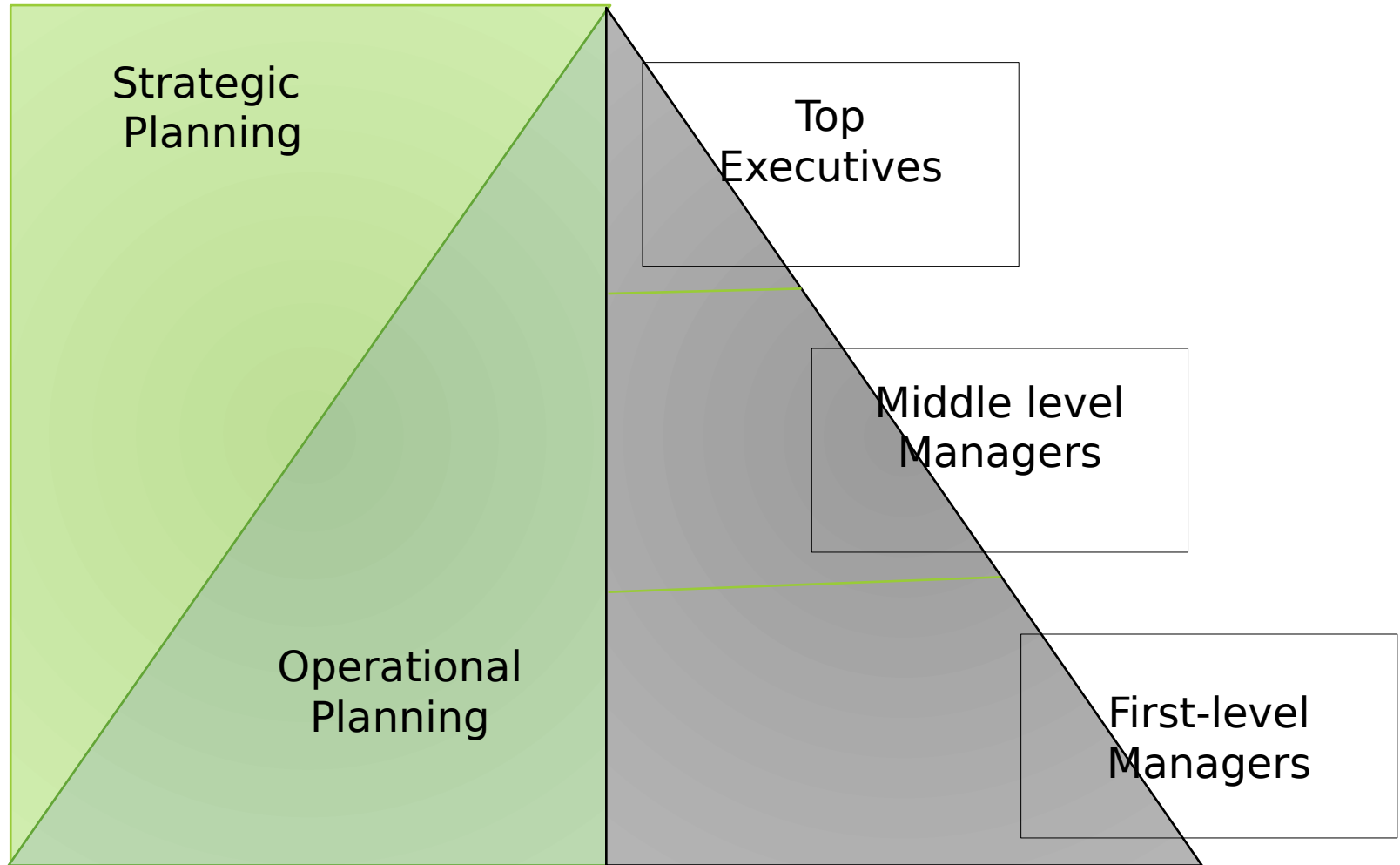
Short-term

-less than 3 years

Single use

- one time plan
- designed for specific purpose or unique situation

Standing

- regularly prepared plan - annual plans etc.

Planning in the Hierarchy of Organizations

Strategic Planning

Operational Planning

Top Executives

Middle level Managers

First-level Managers

The Foundation for Planning

A successful enterprise needs to **develop effective strategies** for achieving its **mission**, and strategic planning is the organized process for selecting these strategies.

Customer focus/ customer driven

A clear vision of the basic purpose or mission for which it exists is essential to the long-term success of any enterprise

Strategic planning **suggests ways (strategies) to identify and to move toward desired future states**.

Determines where the **organization is going over the next year or more**, **how it is going to get there**, and **how it will know if it got there or not**.

Consists of the **process of developing and implementing plans to reach goals and objectives**.

Strategic planning is a disciplined effort to produce **fundamental decisions and actions** that **shape and guide *what* an organization is, *what* it does, and *why* it does it, with a focus on the future, both internally and externally**.

```
                    ┌─────────────────────────────┐
                    │        Vision/Mission        │
                    │  Aligned toward meeting      │
                    │  customer expectations and   │
                    │  within framework of         │
                    │  organization's philosophy   │
                    └─────────────────────────────┘
                                   │
     ┌──────────────────┐          │          ┌──────────────────┐
     │  SWOT Analysis    │─────────┼──────────│    Forecasting    │
     │  Gap Analysis     │          │          └──────────────────┘
     └──────────────────┘          │                    │
                                   ▼                    │
                    ┌─────────────────────────────┐    │
                    │      Strategic Issues        │◄───┘
                    └─────────────────────────────┘
                                   │
                                   ▼
                    ┌─────────────────────────────┐
                    │     Ongoing Strategic        │
                    │     Planning, Goals          │
                    │     Objectives, Strategies   │
                    └─────────────────────────────┘
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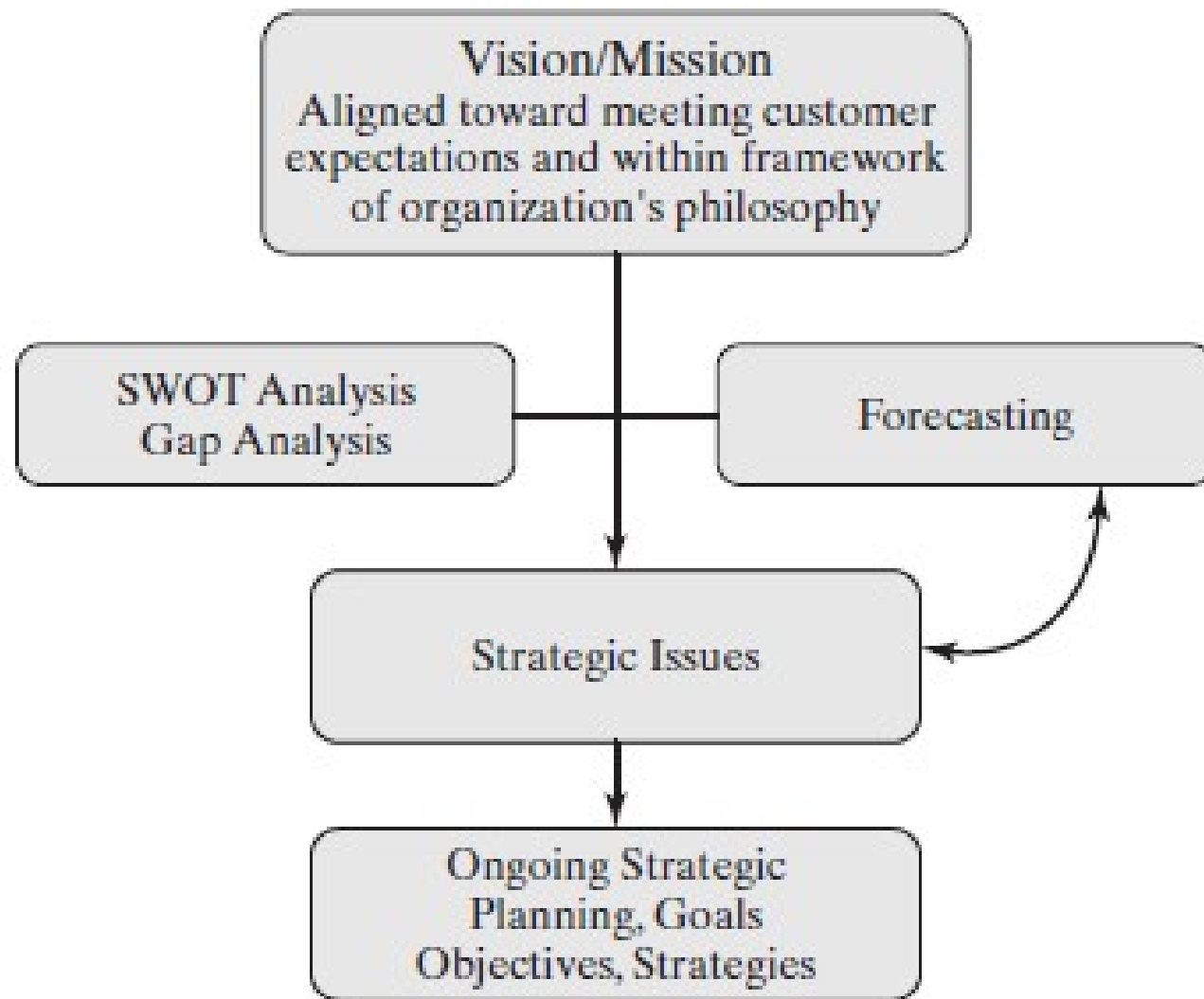
What is a vision statement?

Your vision statement gives the company direction. It is the future of the business, which then provides the purpose. The vision statement is about what you want to become. It's aspirational.

Vision statement questions look like:
•What are our hopes and dreams?
•What problem are we solving for the greater good?
•Who and what are we inspiring to change?

SAMPLES **VISION STATEMENTS**

AMAZON
Our vision is to be earth's most customer centric company; to build a place where people can come to find and discover anything they might want to buy online.

DEUTSCHE BANK
We aspire to be the leading client-centric global universal bank.

UNICEF
UNICEF is the driving force that helps build a world where the rights of every child are realized.

What is a mission statement?

Your mission statement drives the company. It is what you do/the core of the business, and from it come the objectives and finally, what it takes to reach those objectives. It also shapes your company's culture.

Mission statement
questions look like:
- What do we do?
- Whom do we serve?
- How do we serve them?

SAMPLES **MISSION STATEMENTS**

APPLE

We design the best personal computers in the world, lead the digital music revolution, reinvented the mobile phone, and are defining the future of mobile media and computing devices.

GAP

We create emotional connections with customers around the world through inspiring product design, unique store experiences, and compelling marketing.
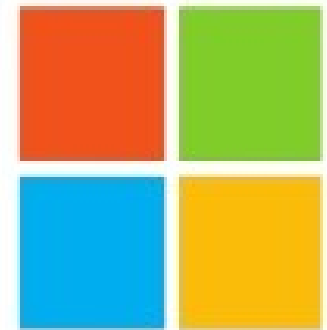
MICROSOFT

Our mission is to enable people and businesses throughout the world to realize their full potential.

A vision statement describes in graphic terms where the goal setters want to position themselves in the future.

"Where do I see my business going?"

A mission statement resembles a vision statement, but has a more immediate business focus with a time horizon.

"Why does my business exist?"

◦ The mission statement sets forth what the company is attempting to do and is usually what the public sees.

◦ The role of an organization's mission and vision is to align work toward meeting customer expectations.
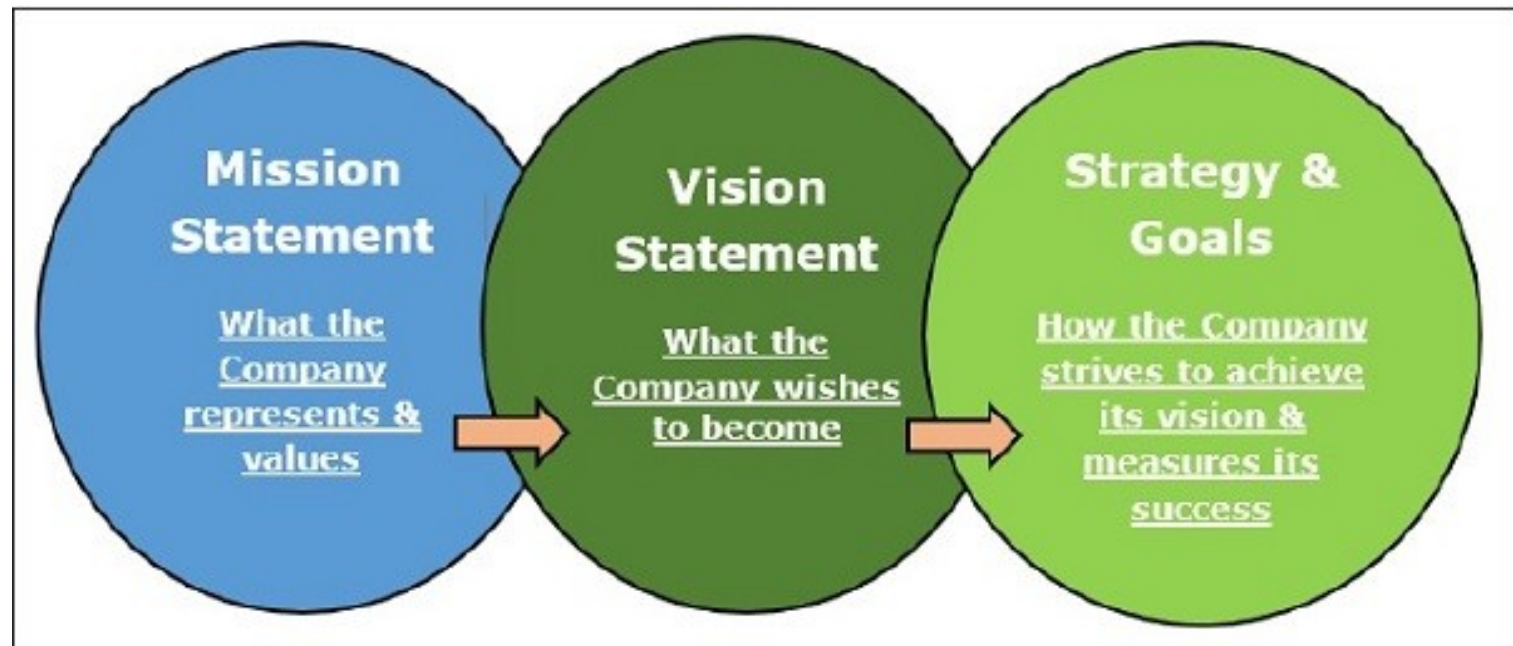
What is the difference between a vision and a mission?

The vision statement focuses on tomorrow and what the organization wants to become. The mission statement focuses on today and what the organization does. While companies commonly use mission and vision statements interchangeably, it's important to have both. One doesn't work without the other, because having purpose

DIFFERENCE	VISION	MISSION
ANSWERS QUESTION	**Why** are we here?	**What** do we do? For **whom** do we do it? What is the **benefit**?
TIME	Vision Statement talks about the **very long term future**. In an **ideal** world our vision would be…	Mission Statement talks about the organisation's **present** leading to the future.
CHANGE	Your Vision should remain **intact**, even if the market changes dramatically, because it speaks to what your company represents, not just what it does.	Mission Statement may **change** if your organization outlives the industry it started in, but it should still tie back to your core vision and values.
ABOUT	Vision statement outlines **WHERE** an organization wants to be in future. Communicates both long term purpose and **values** of the organization.	Mission Statement talks about **HOW** the organization will get where it wants to be. Defines the organization's purpose and primary objectives. Mission Statement puts the Vision into practice.
FUNCTION	Describes where the organization sees itself **years from now**. Shapes **customer's understanding** of why they should work with the organization.	Lists **broad goals** for which the organization is formed. Prime function is **internal**, to define the key measure of success and its prime audience is leadership team and stockholders
EMPLOYEES	Identifies **why** employees need/want to work with the organization and gives direction about how they are **expected to behave** and **inspires** them to give their best.	Helps the team act and **guides** them in what they should do.

Mission—Southwest Airlines

The mission of Southwest Airlines is dedication to the highest quality of Customer Service delivered with a sense of warmth, friendliness, individual pride, and Company Spirit.

At Southwest Airlines, our Mission Statement has always governed the way we conduct our business. It highlights our desire to serve our Customers and gives us direction when we have to make service-related decisions. It is another way of saying, "We always try to do the right thing!" Our Mission Statement has also led the way to the airline industry's best cumulative consumer satisfaction record, according to statistics accumulated and published by the U.S. Department of Transportation. That is why we are sharing it with you.

Source: http://www.southwest.com, 7/7/2012.

	Walmart	Ford Motor
Vision	To become the world wide leader in retailing.	To become the world's leading consumer company for automotive products and services.
Mission	To help people save money so they can live better.	… . We anticipate consumer need and deliver outstanding products and services that improve people's lives.

Mission & Vision

- Mission: "*The Coca-Cola Company*...strive[s] to refresh the world, inspire moments of optimism and happiness, create value and make a difference."

- Vision

  - People: *Encourage and inspire employees to be their best.*

  - Portfolio: *Supply people, globally, with top notch beverages.*

  - Partners: *Create and foster relationships with consumers and suppliers.*

  - Planet: *Practice Corporate Social Responsibility and "Get Involved".*

  - Profit: *"Maximize long-term return to shareowners while being mindful of... [their] overall responsibilities."*

  - Productivity: *Be efficient and "highly effective".*

Kathmandu University

Vision

To become a world class university devoted to bringing knowledge and technology to the service of mankind.

Mission

To provide quality education for leadership.

F1Soft Group

Mission

CONNECT PEOPLE TO FINANCIAL SERVICES IN SIMPLE, SECURE, AND AFFORDABLE WAYS.

Vision

To become a household brand used by every Nepali to meet their daily digital consumption needs.

eSewa

Mission

As a pioneer in the digital payment industry and as a pacesetter in Nepal, eSewa is driven by a mission to provide a secured, integrated and most comprehensive payment process for businesses, associations, etc. by going above and beyond to help customers, banks, merchants, and maintaining high-quality customer service and risk management.

Vision

eSewa envisions to create a cashless economy by covering every part of the payment sector (Big/Small, Retail/Wholesale, Public/Private), provide quality financial service, and become the most preferred service provider in the country.

Values

With a group of dynamic individuals that make up the team of eSewa, the company values trust, innovation, and works to achieve growth with whatever it takes.

Fonepay

Mission

Connecting people to financial services through technology and enabling their inclusion in the formal economy.

Vision

We are working towards a shared vision to serve every Nepali citizen every single day through digital finance.

eSewa Money Transfer

Mission

To empower lives of migrants and their families by making money transfers instant, economical and accessible through the use of technology.

Vision

To become the most admired remittance company of the new millennium with a focus on going digital.

SWOT ANALYSIS

	Helpful to achieving the objective	Harmful to achieving the objective
Internal origin (attributes of the organization)	Strengths	Weaknesses
External origin (attributes of the environment)	Opportunities	Threats

Internal
◦ Strengths
◦ Weaknesses

External
◦ Opportunities
◦ Threats

Build on Strengths
Resolve Weaknesses
Exploit Opportunities
Avoid Threats

SWOT Analysis

Mission

Internal Strengths

External Opportunities

Analysis

Internal Weaknesses

External Threats

Strategy
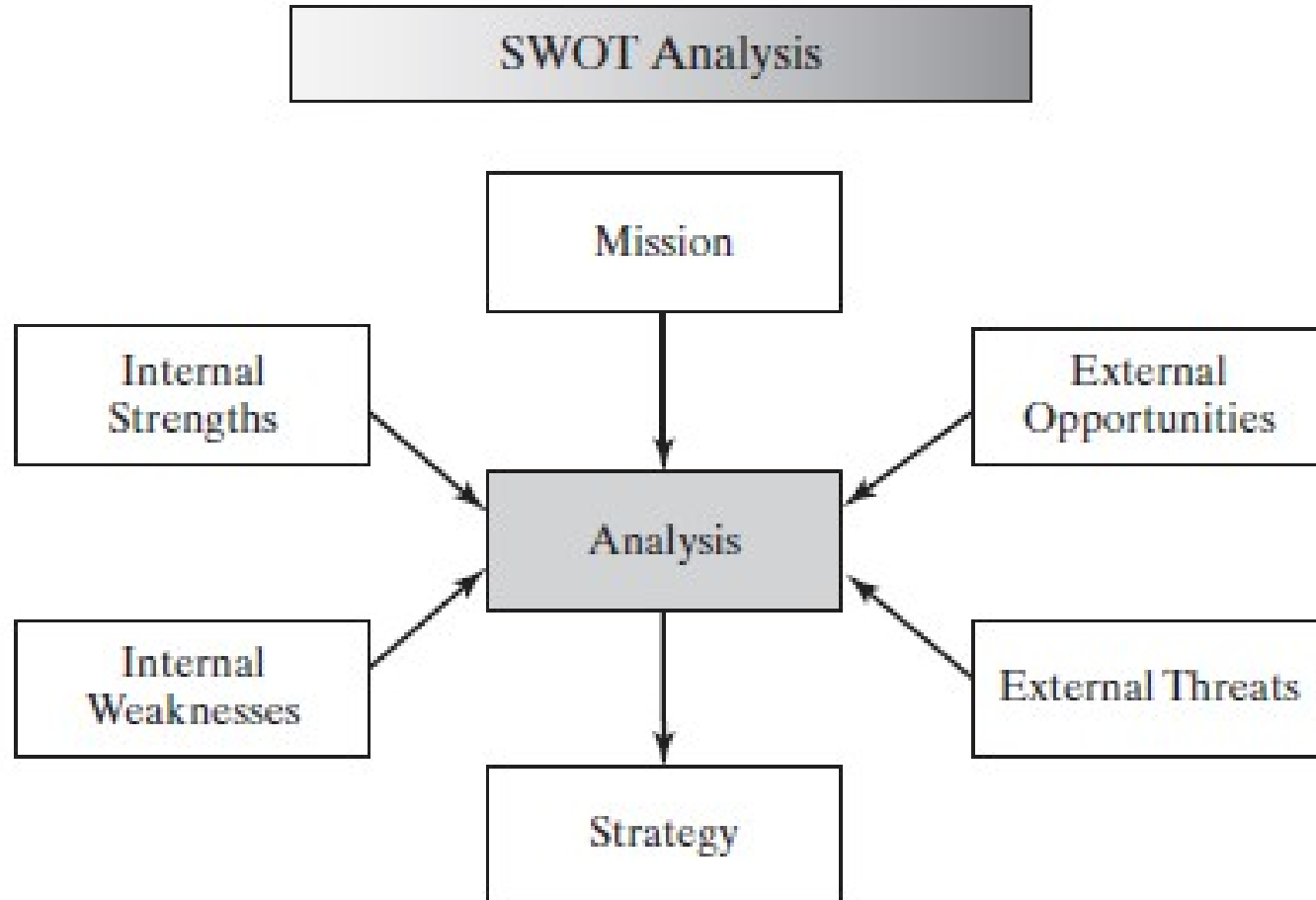
Gap analysis is a technique used to analyze/assess where you currently are with respect to where you would like to be in the future.

SWOT analysis evaluates a company against its peers, while GAP analysis is an internal evaluation to identify performance deficiencies.

SWOT analysis is done for long-term planning while GAP analysis is often done to reach short term goals.

SWOT analysis is often a comprehensive study evaluating many aspects and many competitors. GAP analysis can be very simple targeted towards fine-tuning one process.

Goals give purpose and direction to accomplish the mission of an organization.

The goal statement answers
- What do we do?
- Why do we do it?
- For whom do we do it?

The **objectives** further clarify the goal and answer
- How do we go about it?

Strategies are statements about the way objectives are to be achieved.

Official goals are typically found in a company's mission or vision statement, and communicate the general purpose of the organization.

◦ These types of goals are often *qualitative*, which means they're subjective and harder to measure.

Operative goals describe the steps the organization will take to achieve its purpose.

◦ Operative goals also tend to be measured *quantitatively*, which means they are based on metrics.

Operational goals define the business processes needed to achieve operative goals.

EXAMPLE

◦ Official Goal
  ◦ 'To provide our clients with excellent service by improving the quality of your living space and that of your pet'.

◦ Operative Goal
  ◦ 'To gain additional market share and opportunities in the local market.'

◦ Operational Goal
  ◦ 'To hire a digital and social marketing team to increase brand recognition in the local market'.

The Planning Process
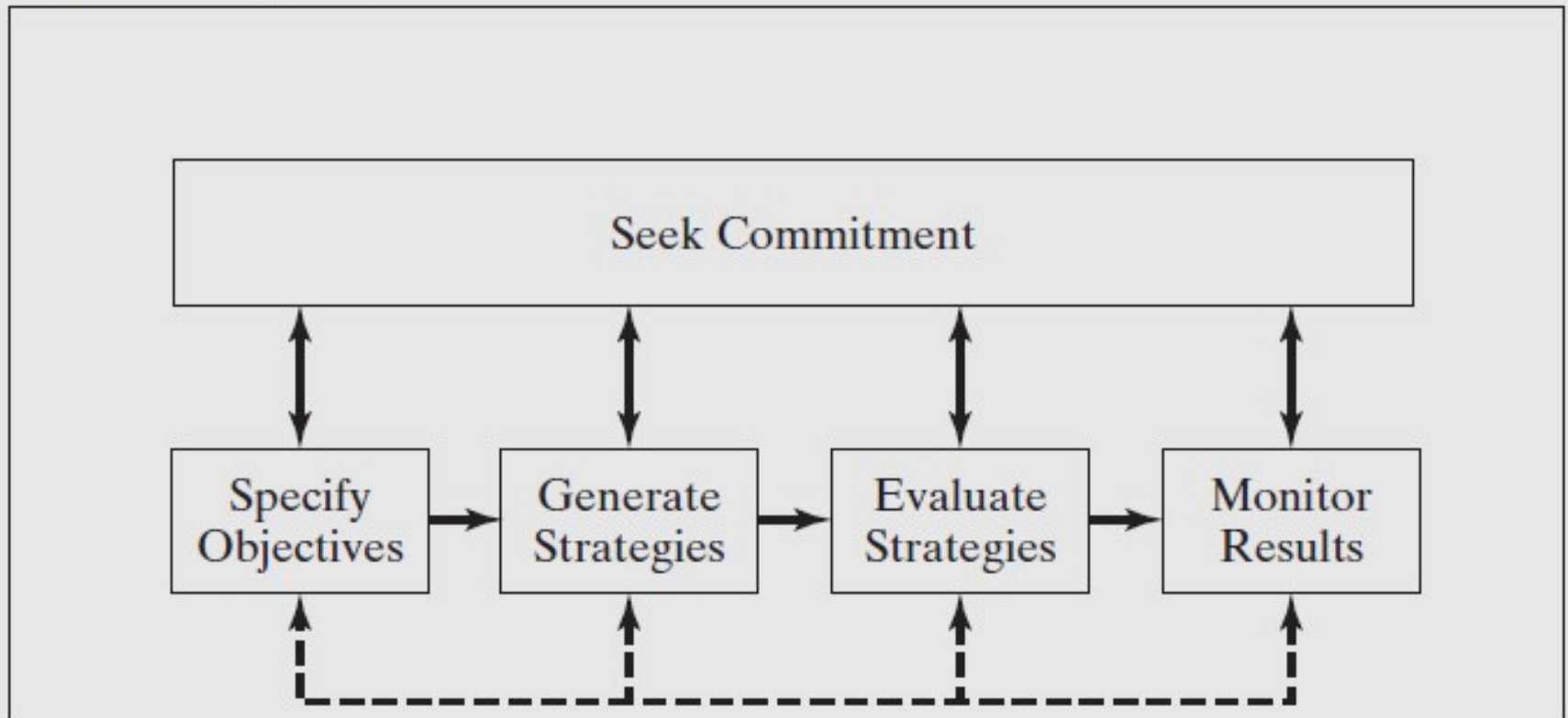
According to Peter Drucker, managers must pursue clear objectives in the following eight *key result areas*:

- Marketing
- Innovation
- Human organization
- Financial resources
- Physical resources
- Productivity
- Social responsibility
- Profit requirements

The only business purpose

To create a customer

2 basic functions

Marketing

Innovation

8 key areas for setting objectives

Marketing

Physical resources

Innovation

Productivity

Human organization

Social responsibility

Financial resources

Profit requirements

1. Marketing (Market Share): company $sales/total $sales of everyone in market
2. Innovation: want more sales in new products
3. Productivity: more goods + services per input
4. Physical and Financial Resources: goals for resources
5. Manager Performance and Development: availability of managers in required quality and quantity
6. Worker Performance and Attitude: respect for individual employee
7. Profitability: so as to measure enterprise success
8. Social Responsibility: effect on the environment

Management by Objectives (MBO)

Translating broad organizational goals and objective into specific individual objectives

Superior and subordinate should have common understanding of goals and objectives
- They meet to establish objectives for the subordinate's attention over six month or a year

S.M.A.R.T Objectives
(**S**pecific, **M**easurable, **A**ttainable, **R**ealistic/Relevant, **T**ime-Bound)

Evaluation of subordinate's success at the end

Forecasting

Essential preliminary to effective planning

Planning provides the strategies, given certain forecasts, and forecasting estimates the results, given the plan.

Planning is what the organization out to do, and forecasting relates to what happens if the firm tries to implement given strategies in a possible environment.

Engineering manager must be concerned with both future markets and future technology, and must therefore understand both sales and technological forecasting.

Why Forecasting?

New facility planning

Production planning

Work force scheduling

Long Range Forecasts

Design new products

Determine capacity for new product

Long range supply of materials

Short Range Forecasts

Amount of inventory for next month

Amount of product to produce next week

How much raw material delivered next week

Workers schedule next week

Forecasting Methods

Qualitative Methods	Quantitative Methods
Jury of Executive Opinion	Simple Moving Average
Delphi Method	Weighted Moving Average
Sales Force Composite	Exponential Smoothing
Users' Expectation	Regression Models

Qualitative Methods

Jury of Executive Opinion

Senior managers draw upon their collective wisdom to map out future events.

Managers from sales, marketing research, accounting, production & advertising assemble to discuss their opinions on what will happen to sales in future.

The Delphi Method

Drawing upon the group's expertise by getting individual submissions, without the drawback of face to face meetings.

Used to make long-range projections by group of experts.

Gather, evaluate, and summarize expert opinions as the basis for a forecast.

Multiple Round of Questionnaire to Panels:
1.   Chose a facilitator *(coordinator, scrum master)*
2. Identify Experts
   (on topic, a designer, a Backend Developer, a Release Engineer, a load tester, a PM)
3. Define Problem clearly
   ($ currency in mob banking)
4. Send Questions to experts, multiple round, each round go deeper to problem or solutions on based on answer, more complex more rounds.
5. Act on finding, put plans in place, to deal with future risks. The likelihood of impact in project.

Sales Force Composite

- Each salesperson projects their sales
- Combined at district & national levels
- Sales rep's know customers' wants
- Tends to be overly optimistic

Sales

© 1995 Corel Corp.

Users' Expectation

Ask the customers to project their needs for the future period.

Applicable to situations in which potential purchasers are well defined and limited in number, such as industrial markets.
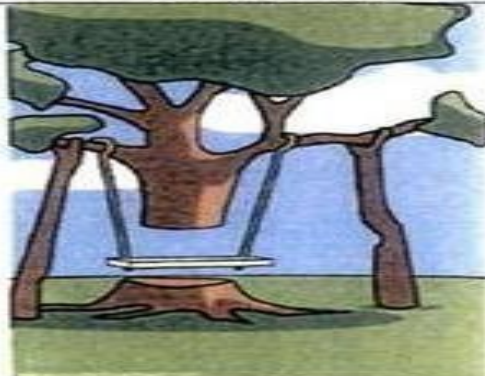
Forecast survey of a limited and well-defined group of buyers.
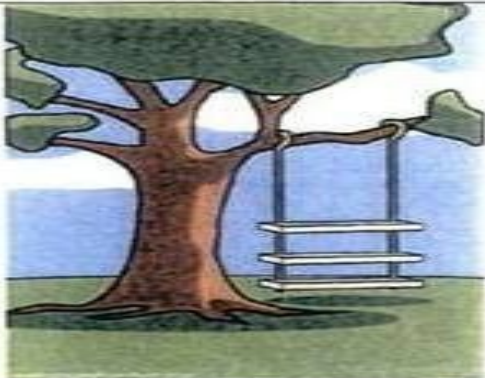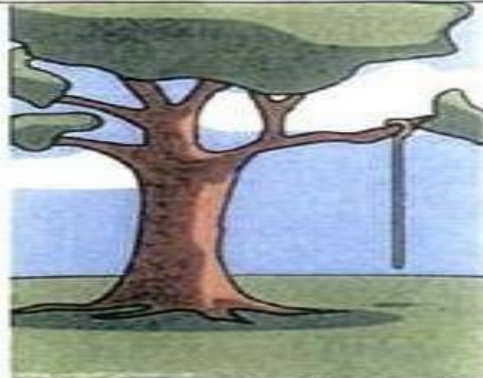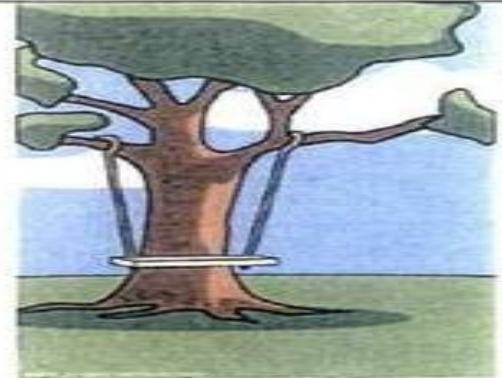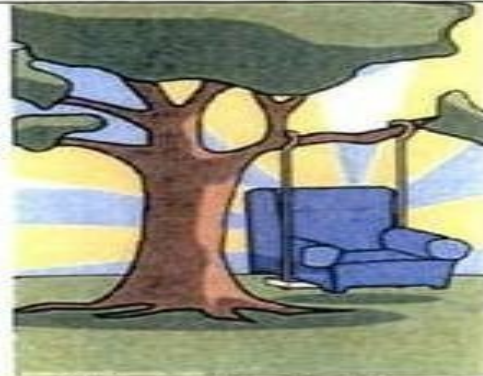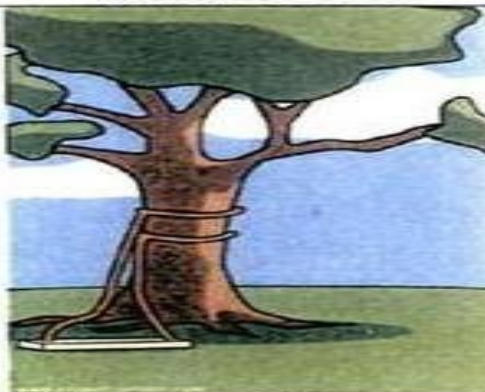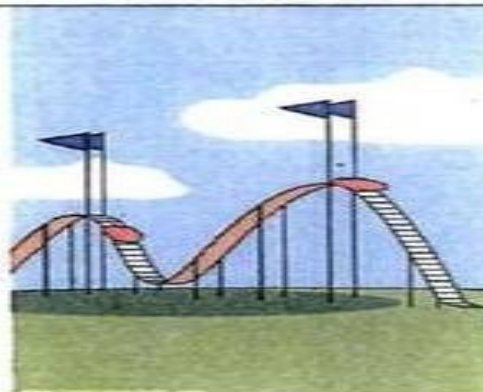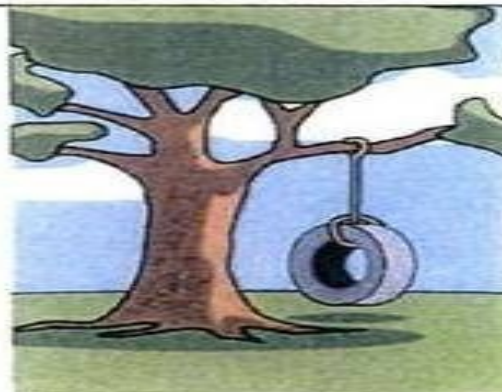
Qualitative Methods

Simple Moving Average

$$F_{n+1} = \frac{1}{n}\sum_{t=1}^{n} A_t$$

$F_{2009} = \dfrac{1600+1200+1300+1100}{4}$

2005	2006	2007	2008	2009
1100	1300	1200	1600	1300

Weighted Moving Average

$$F_{n+1} = \sum_{t=1}^{n} w_t A_t, \text{ where } \sum_{t=1}^{n} w_t = 1.0$$

$F_{2013} = 0.4 \times A_{2012} + 0.3 \times A_{2011} + 0.2 \times A_{2010} + 0.1 \times A_{2009}$

$F_{2013} = 0.4 \times 1600 + 0.3 \times 1200 + 0.2 \times 1300 + 0.1 \times 1100$

$F_{2013} = 1370$

Table 4-2   Exponential Smoothing Calculation

| Year(t) | Forecast F_t | | Actual Value A_t |
	$\alpha = 0.3$	$\alpha = 0.6$	
2009			1,100
2010	1,100	1,100	1,300
2011	1,160	1,220	1,200
2012	1,172	1,208	1,600
2013	1,300	1,443	

Exponential Smoothing

$$F_{n+1} = F_n + \alpha(A_n - F_n) = \alpha A_n + (1 - \alpha) F_n$$

$$F_{n+1} = \alpha A_n + (1 - \alpha)[\alpha A_{n-1} + (1 - \alpha)F_{n-1}]$$
$$= \alpha A_n + \alpha(1 - \alpha)A_{n-1} + \alpha(1 - \alpha)^2 A_{n-2} + \alpha(1 - \alpha)^3 A_{n-3} + \cdots$$

For example, if $\alpha = 0.3$,

$$F_{2011} = 0.3 A_{2010} + 0.7 F_{2010}$$
$$= 0.3(1{,}300) + 0.7(1{,}100) = 1{,}160$$
$$F_{2012} = 0.3 A_{2011} + 0.7 F_{2011}$$
$$= 0.3(1{,}200) + 0.7(1{,}160) = 1{,}172$$

Regression Models

- Attempts to develop logical relationship for forecasting
- Identifies causes and factors for forecast value
- Assumes, linear relationship exists between dependent(1) and independent (1+)

$$D = a + bI$$

Simple Regression

$$b = \frac{n \sum (D_i I_i) - \sum I_i \sum D_i}{n \sum (I_i^2) - (\sum I_i)^2}$$

$$a = \sum \frac{D_i}{n} - b \sum \frac{I_i}{n} = \overline{D} - b\overline{I}$$

Multiple Regression

$$D = c_0 + c_t I_j + \frac{c_2}{I_2} + c_3 I_3^2 + \cdots$$

Technological Forecasting

It is essential that planning be done according to the best estimate of the technology that will be available in the future.

The feasibility of technological forecasting is based on three premises:

1. Technological events and capabilities grow in very organized manner;
2. Technology responds to needs, opportunities, and the provision of resources; and
3. New technology can be anticipated by understanding the process of innovation.

According to Marvin Cetron, a technological forecast is a prediction, based on confidence that certain technical developments can occur within a specified time with a given level of resource allocation.

Two types of technological forecasting:
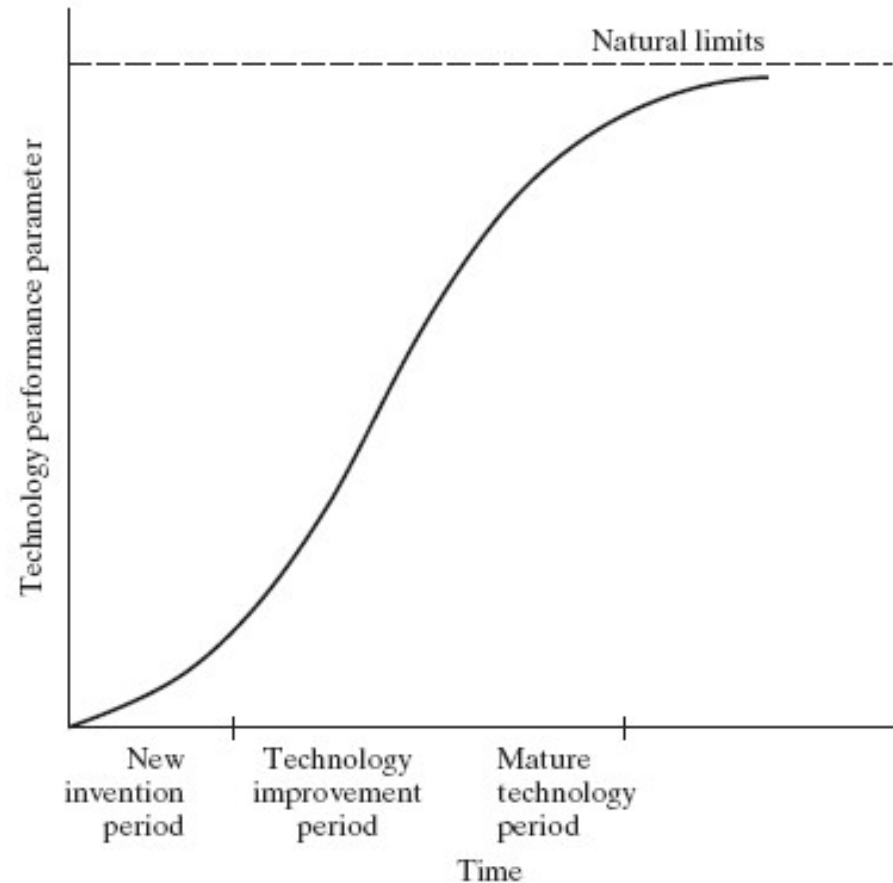- Normative
- Exploratory

In normative technological forecasting, one works from the future to the present.

A desired future goal is selected, and a process designed to achieve this goal is developed.
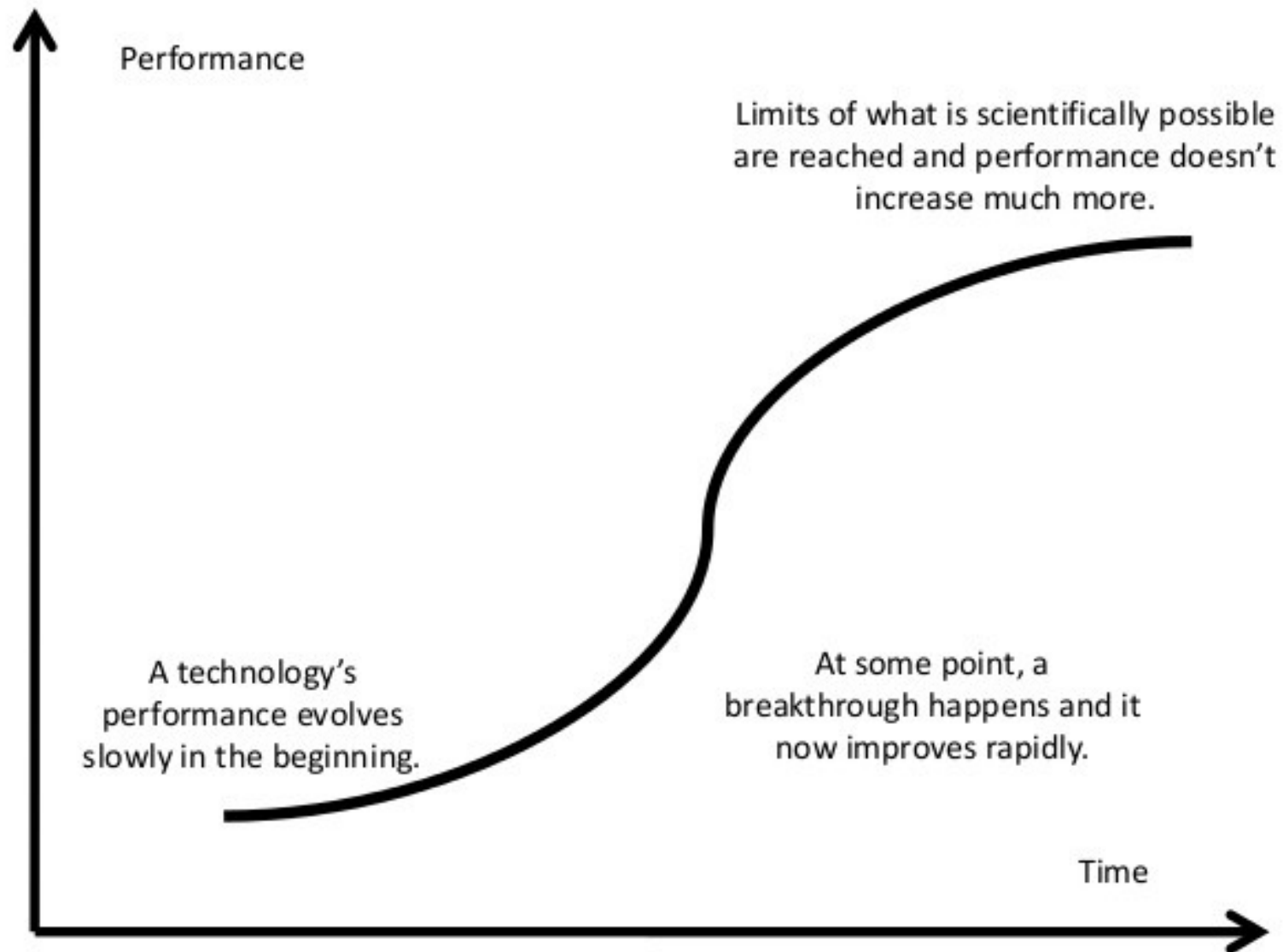
An exploratory technological forecasting begins with current state of technology and extrapolates into the future.
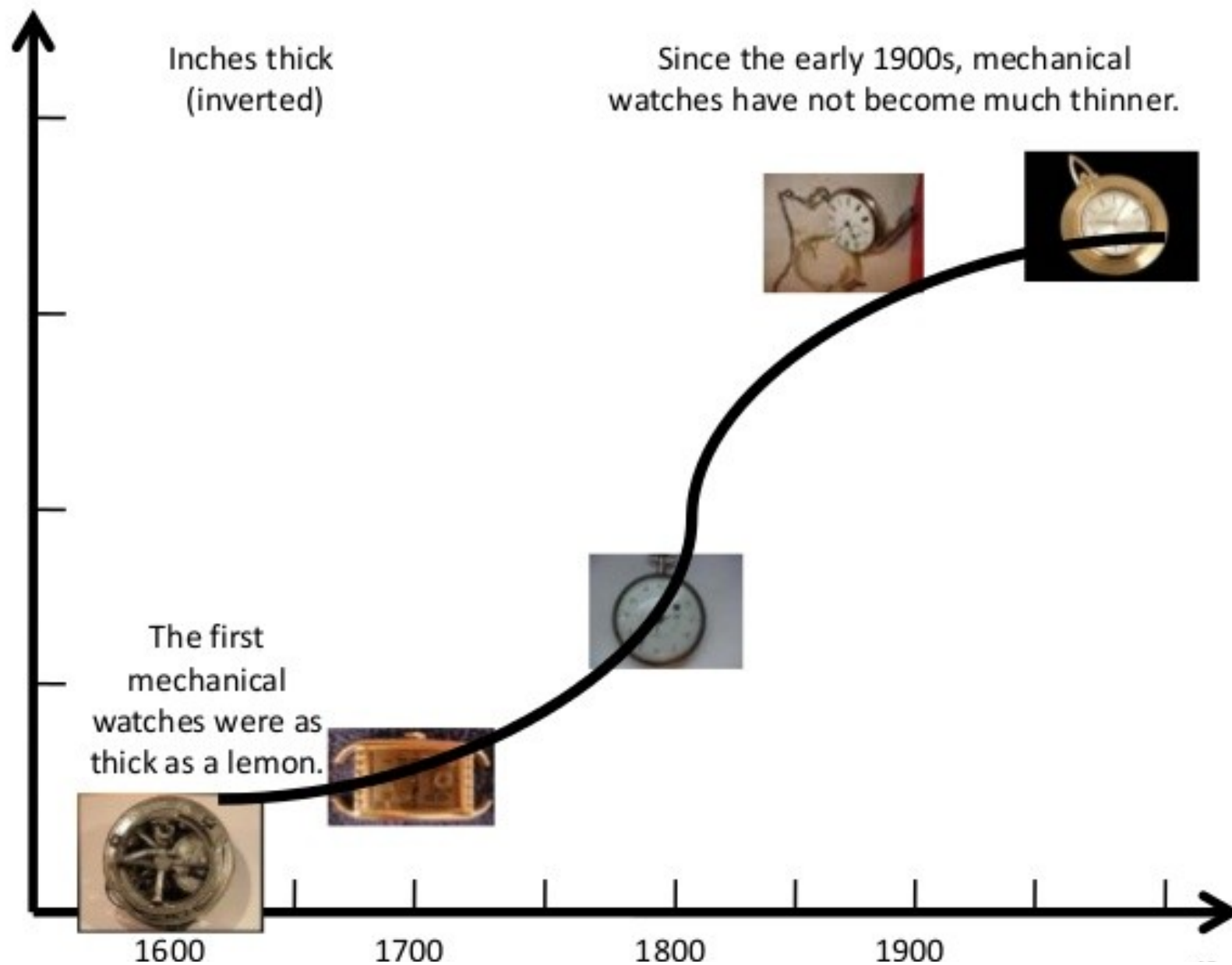
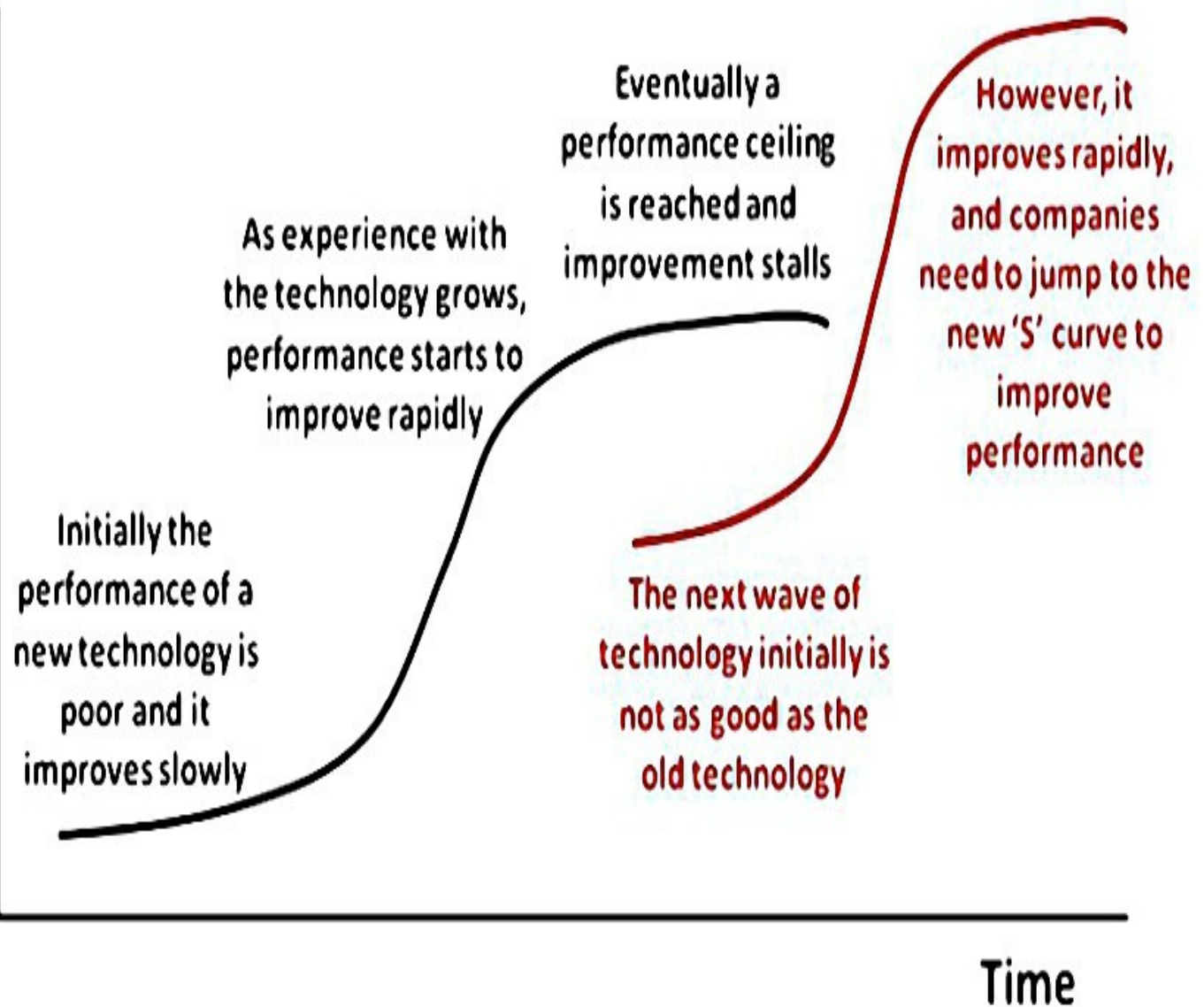○ Delphi method

Technology S-curve

Figure 4-4 Technology S-curve. (From Frederick Betz, *Managing Technology: Competing Through New Ventures, Innovation, and Corporate Research*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1987, p. 62; reprinted by permission of Prentice-Hall, Inc., copyright 1987).
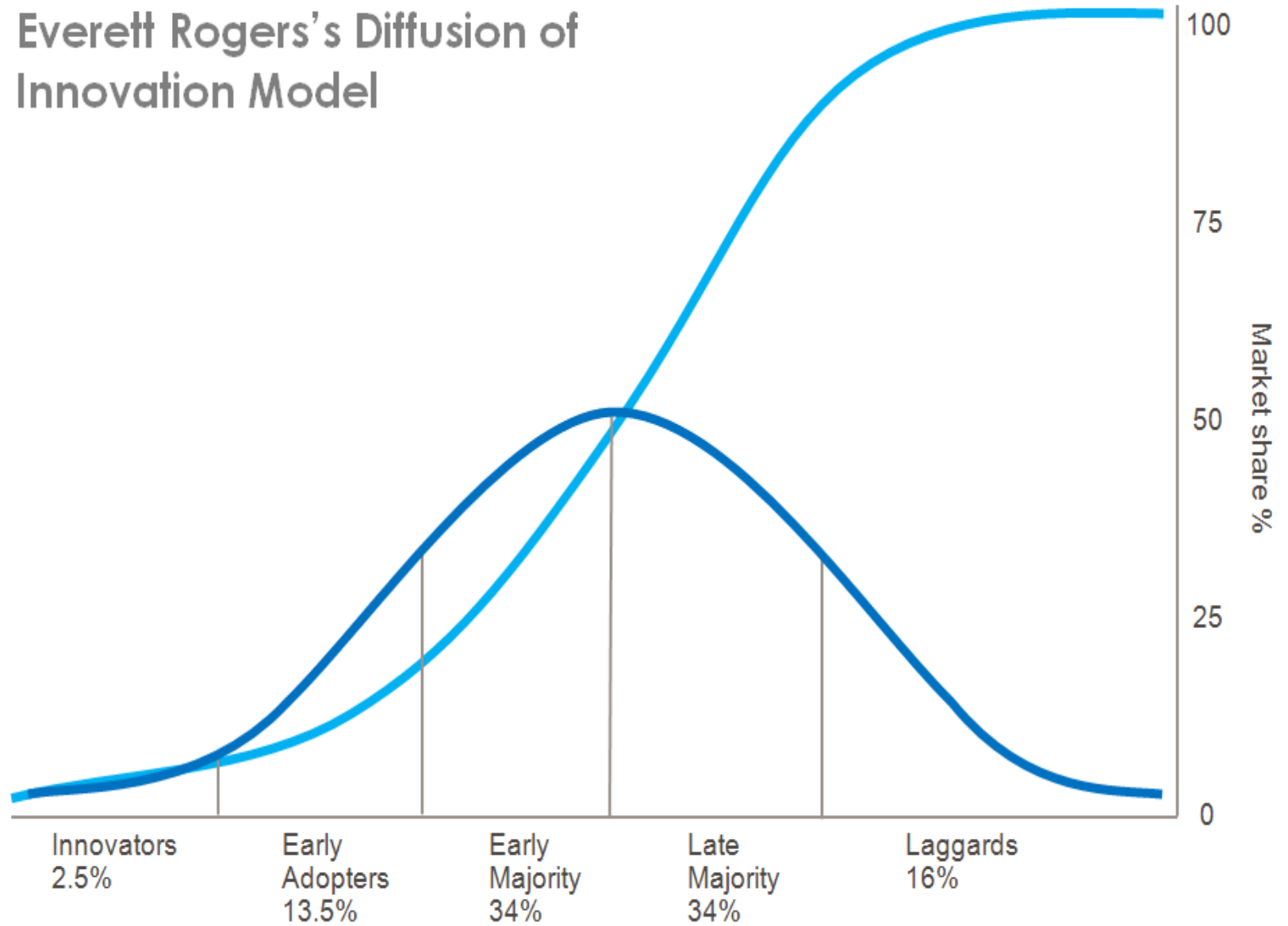
Inches thick
(inverted)

Since the early 1900s, mechanical watches have not become much thinner.

The first mechanical watches were as thick as a lemon.

1600   1700   1800   1900

Performance / Time

Initially the performance of a new technology is poor and it improves slowly

As experience with the technology grows, performance starts to improve rapidly

Eventually a performance ceiling is reached and improvement stalls

The next wave of technology initially is not as good as the old technology

However, it improves rapidly, and companies need to jump to the new 'S' curve to improve performance

Everett Rogers's Diffusion of Innovation Model

Strategies for Managing Technology

Invention and Innovation

Managing Technological Change

INVENTION
VERSUS
INNOVATION

Invention: The creation of something new	**Innovation:** The creation of something new + its implementation and thereby the creation of value
Many inventions don't become innovations because they are not implemented and **never create any value**	Inventions that are turned into innovations improve people's lives and often help us to do **solve a need better than existing solutions**
Example: Light bulb The first light bulbs did not create any value as they did not last for long	**Example: Edison's light bulb** Years after the first light bulb, Edison created a viable product that could be used