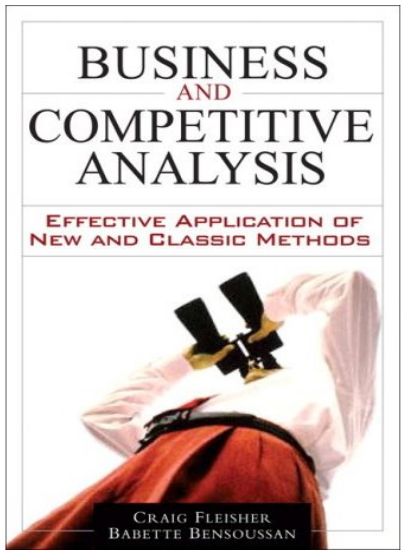


FT Press
FINANCIAL TIMES

Chapter 22

Technological Forecasting

Ch22. Technological Forecasting

- Short Description
- Background
- Strategic Rationale & Implications
- Strengths & Advantages
- Weaknesses & Limitations
- Process for Applying Technique
- Summary
- Case Study: Bell Canada & Delphi Technique
- FAROUT

Ch22. Technological Forecasting

Short Description

- Technological forecasting provides information about the direction and rate of technological changes.
- It uses logical processes to generate explicit information to help industry and government anticipate practical, ecological, political, and social consequences of developments in technology.
- There are four elements in a technological forecast (Martino, 1983):
  - A time horizon.
  - A specific technology.
  - Some parameters to the technology.
  - A probability statement about the outcome.

Ch22. Technological Forecasting

Background

- Technology experienced an explosion in growth after WWII.
- Following the radical growth in technological development competition has become intense and unpredictable.
- Technological forecasting has roots in the US space and defence industries in the 1940s and 1950s.
- It was used by the US as a tool to keep its technology ahead of the Russians during the Cold War.
- Change of technology may mean:
  - modification of government policy.
  - loss of market share.
  - loss of a market (obsolescence).

Ch22. Technological Forecasting

Strategic Rationale and Implications

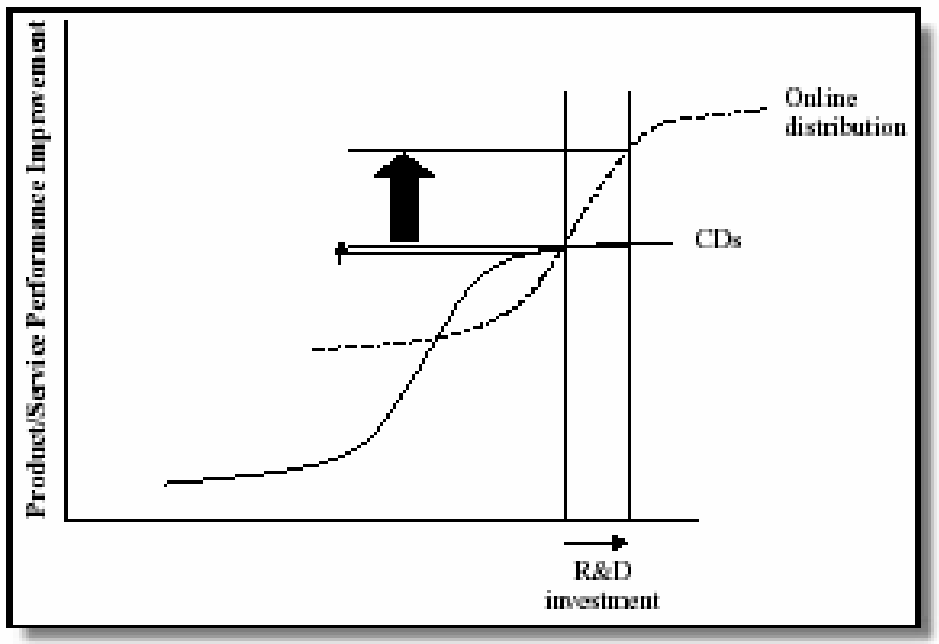
- The products a firm markets, the processes a firm uses or the equipment it uses may be superseded.
- This gives a competitor an advantage.
- Can gain a price advantage over competitors by investing in more efficient technological processes.
- Internal functioning of a business relies on technology.
- Technological forecasting predicts future developments by anticipating the probable characteristics and timing of technology.

Ch22. Technological Forecasting

Strategic Rationale and Implications

- Below is an example of a traditional business model when compared to the potential impact of an alternative technology.

Online Distribution versus CD Technology in the Recording Industry



SOURCE: Adapted from "Boosting the Payoff from R&D," by R. N. Foster, 1982, *Research Management, 15*(1), pp. 22–27.

Ch22. Technological Forecasting

Strategic Rationale and Implications

- There are a variety of methods used to generate technological forecasts:
  - Expert opinion (Delphi).
  - Trend extrapolation and growth curves.
  - Morphological analysis.
  - Monitoring.
  - Relevance trees.
  - Historical analogy.
  - Scenarios.

Ch22. Technological Forecasting

Strengths and Advantages

- Can inform current and future investment decisions throughout a business.
- Flexible process that can be tailored to a business.
- The variety of methods available so a firm can choose a method appropriate its budget.
- The individual methods all have their own particular strengths.
  - The Delphi method: allows a firm to tap into the expertise of experts across a range of fields.
  - Trend extrapolation: uses statistical data to assist in the development of indicators.

Ch22. Technological Forecasting

Strengths and Advantages

- **Growth curves:** usefully predict when a technology had reached maturity.
- **Relevance trees:** identify relationships between parts of a technology or process and its potential development.
- **Morphologicial analysis:** gives detailed analysis of the current and future structure of an industry.
- **Monitoring:** of patents and general research trends can give a firm warning of new inventions.

Ch22. Technological Forecasting

Weaknesses and Limitations

- Is heavily dependent on the quality of the information and the validity of the assumptions upon which it is based.
- Firm's own staff may not be able to determine which factors are most important.
- Personality of individual on project may infect the message.
- Technological forecasts do not provide conclusive results.
- Attempts to predict probability - difficult to do.

Ch22. Technological Forecasting

Weaknesses and Limitations

- Individual analytical methods all have their own weaknesses:
  - **Delphi method:** Qualified experts are crucial.
  - **Trend extrapolation /growth curves:** future does not always follow the patterns of the past, and dependent on the limits chosen for the analysis.
  - **Relevance trees/morphological analysis:** Subject to human error, vulnerable to lack of insight, and difficult to construct.

Ch22. Technological Forecasting

Process for Applying the Technique

- Determine what the firms wishes to predict.
- Determine the parametres of the analysis.
- Technological forecasting is performed using these common techniques:
  - Delphi Technique - expert opinion.
    - Consensus of opinion to tries to minimise the affect of individual bias.
    - Uses a panel of experts.
    - If the questions being asked are general then the panel should have representatives from a variety of disciplines.

Ch22. Technological Forecasting

Process for Applying the Technique

- Delphi Technique Continued:
  - Questions to put to a panel, you are most likely to want experts with specific experience.
  - A facilitator co-ordinates the process and sends a questionnaire or survey to each of the experts.
  - Essential that the experts be allowed to respond anonymously.
  - Responses are collated by the facilitator and any further clarification is sought.
  - The aim is to find consensus.

Ch22. Technological Forecasting

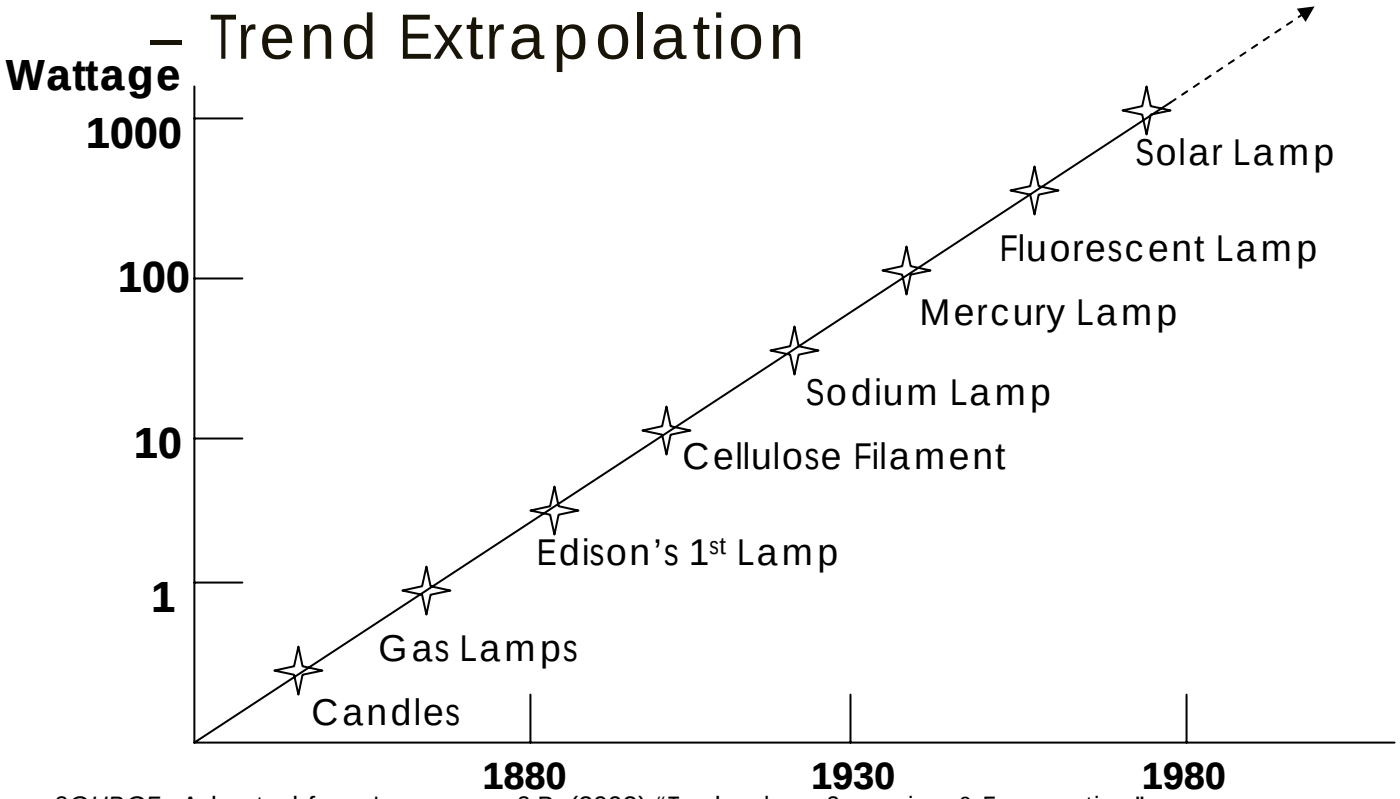
Process for Applying the Technique

- Trend Extrapolation
  - Consider change over a period of time, understand the factors that have driven that change, and predict future change from this knowledge.
  - Generally statistics are plotted onto a graph against time.
  - Limit analysis may be used to check the utility of a trend extrapolation plot.
  - May be used to forecast future in a technology that has a precursor technology with a known path of change.
  - The shape of the curve for the precursor is used as a guide.
  - May also predict future ones on the basis of judgment.

Ch22. Technological Forecasting

Process for Applying the Technique

– Trend Extrapolation

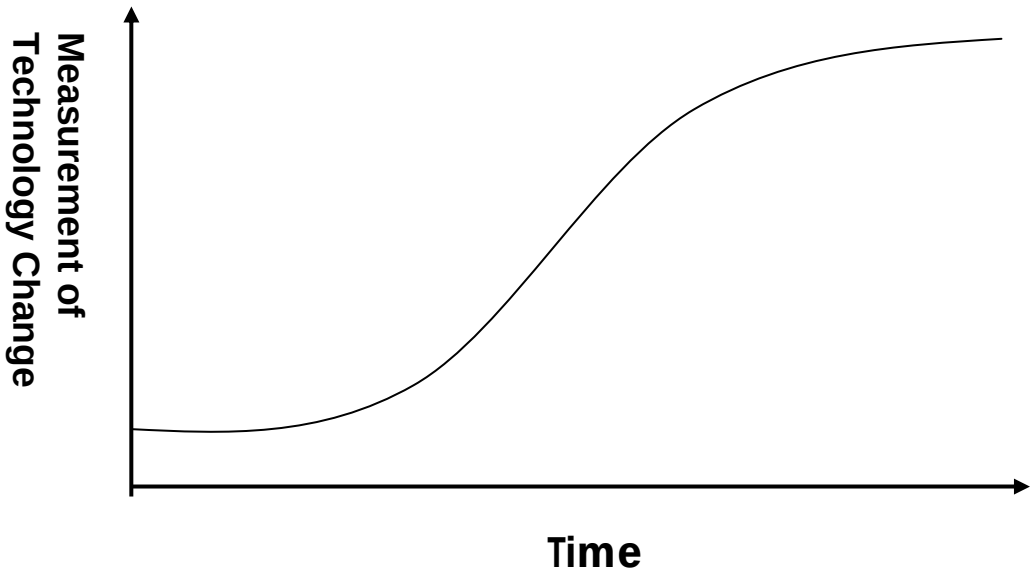


SOURCE: Adapted from Lawrence, S.R. (2002) "Technology Scanning & Forecasting", University of Colorado http://leeds-faculty.colorado.edu/lawrence/mbat6450/docs/schedule.htm

Ch22. Technological Forecasting

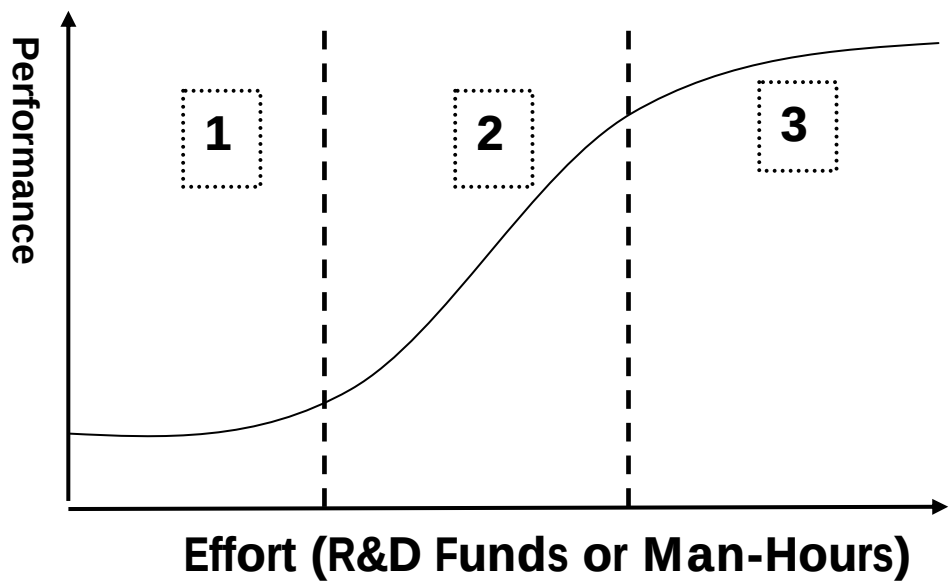
Process for Applying the Technique

- Growth Curves
  - Thought to follow an S-Curve.
    - Generic S-Curve:



Process for Applying the Technique

- Growth Curves
  - S-curve model:



1. **Maturity**
2. **Growth**
3. **Embryonic**

SOURCE: Adapted from Foster, R. N, (1982) "Boosting the Payoff from R&D," *Research Management, 15*(1), pp. 22–27

Ch22. Technological Forecasting

Process for Applying the Technique

- Historical analogy
  - Using historical analogy is a very simple and commonly used method for predicting technological— see chapter 4.7.
- Scenarios
  - Scenarios are not strictly predictive, however they are generally considered a good method for technological forecasting — see chapter 4.3.

Ch22. Technological Forecasting

Process for Applying the Technique

- Morphological analysis
  - Starts with a goal you wish to achieve.
  - Gather information about technologies that may achieve a particular purpose.
  - List the attributes you seek.
  - Display information in graphical form which highlights any gaps.
  - Gaps may represent opportunities for developments.
  - To make this process work, must consider all possibilities.
  - Requires time and patience.

Ch22. Technological Forecasting

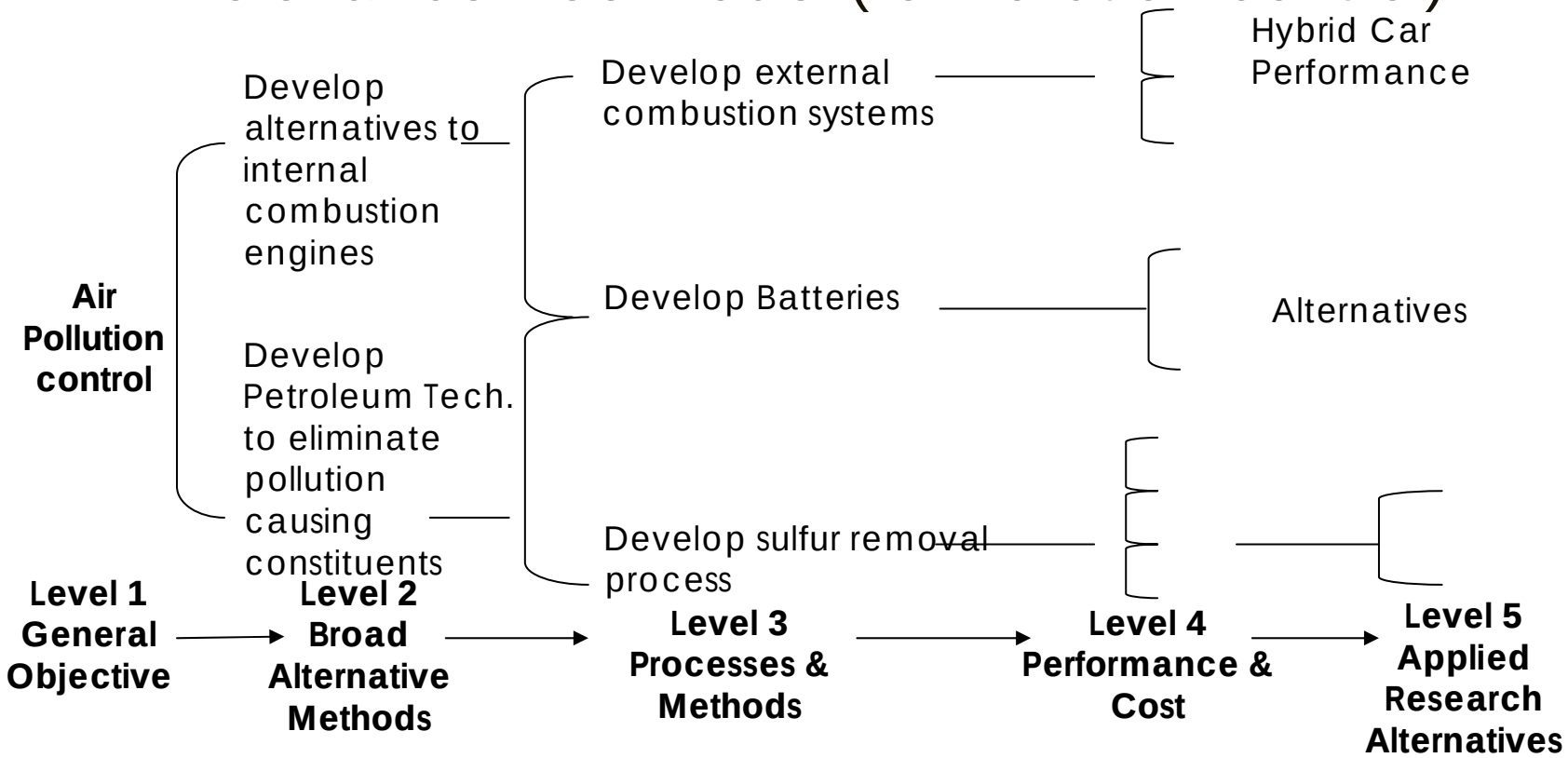
Process for Applying the Technique

- Relevance trees
  - Detailed hierarchies of methods for achieving a particular outcome.
  - This outcome is the question you want answered by your forecast.
  - Divides a broad subject/problem into increasingly smaller and more detailed subtopics.
  - Ideally there should be no overlap between items in the tree.

Ch22. Technological Forecasting

Process for Applying the Technique

– Relevance Tree Model (for Pollution control)



Ch22. Technological Forecasting

Process for Applying the Technique

- Monitoring
  - Often based on careful observation of published research results.
  - Other sources of information for monitoring include industry publications, trade shows, and associations.
  - Analyze discoveries to find the links between observations.
  - Software programs available which facilitate this process.

Ch22. Technological Forecasting

Summary

- Any technique will be irrelevant if you do not use the output of the analysis to enhance your firm's competitive ability.
- No forecast is ever going to be 100% true.
- A forecast is limited by the parameters within which is has been made.
- Should be as aware of the shortcomings of whatever method of forecasting you use, as well as strengths.

Ch22. Technological Forecasting

Case Study: Bell Canada & Delphi Technique

- In the late 1960s the Business Planning Group (The Group) within Bell noted a range of factors likely to lead to significant changes to the business.
  - These included:
    - The merging of computer and communications technologies.
    - New competition due to regulatory changes.
    - Emerging visual telecommunications markets.
    - Anticipated social change.
    - Increasing costs.
  - The Group developed a Delphi study which they implemented in 1970 and which predicted a span of 30 years from 1970 to 2000.

Ch22. Technological Forecasting

Case Study: Bell Canada & Delphi Technique

- The group:
  - Did preliminary research.
  - Created a questionnaire.
  - Tested it on available experts.
  - Re-worded questionnaire.
  - Education, medicine, and business questionnaires started by requesting the panellists give their personal prediction of change to 10 basic values over the next 30 years in North America.
  - The studies then went on to technologies relevant to each area.
  - Questions about likely time frames for adoption of hypothetical technological developments were asked in the medical and business studies.

Ch22. Technological Forecasting

Case Study: Bell Canada & Delphi Technique

- The Group:
  - The residential use study was different in that it focused on future services and not technologies.
  - An early issue with this study was determining what 'experts' should make the predictions about future adoption of technology for the residential market.
  - The Group solved this problem by conducting two separate Delphi processes with the same questionnaire: one using a panel of housewives and other a panel of industry experts.
  - The Delphi process ran for three years.
  - The information from the Delphi process has been used to prepare specific service and business proposals, and to prepare 'environmental outlook reports' which identify future trends that may affect Bell.

Ch22. Technological Forecasting

- **FAROUT Summary**

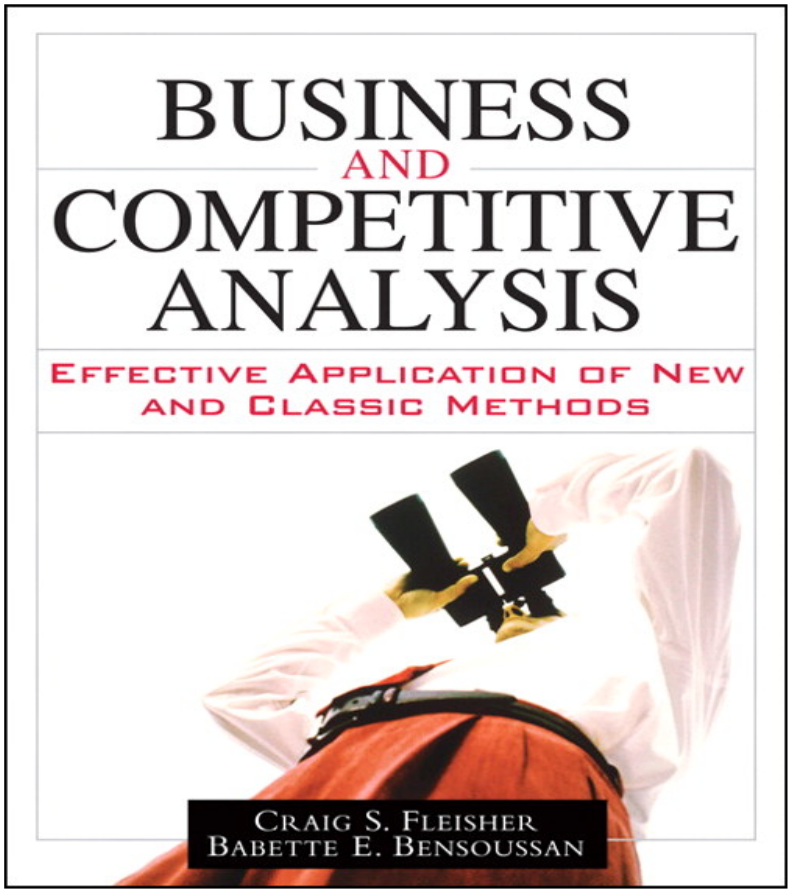
	1	2	3	4	5
F					
A					
R					
O					
U					
T					

Ch22. Technological Forecasting

Related Tools and Techniques

- SWOT Analysis
- Scenario Planning
- Patent Analysis
- Historiographical Analysis

Ch22. Technological Forecasting



For More About Technological Forecasting and 23 Other Useful Analysis Methods, see:

Fleisher, Craig S. and Babette E. Bensoussan

Business and Competitive Analysis: Effective Application of New and Classic Methods

FT Press
FINANCIAL TIMES

Upper Saddle River, NJ
2007