

**Centre for Studies in Science Policy
School of Social Sciences**

Course Title	:	Technology Futures Analysis (TFA)
Course No. & Type	:	SP 605 (M.Phil./Ph.D.) Optional
Faculty in charge	:	Pranav N. Desai & S. Bhaduri
Mode of Evaluation	:	1. A term paper on a selected problem (40%) 2. Seminar presentation (30%) 3. Book Reviews cum Seminars (30%)
Credits	:	4
Instruction Method	:	Lecture-cum-Seminar

I. Nature of the Course

Many overlapping forms of assessing socioeconomic impact of technology and forecasting co-exist. Some of the examples are technology assessment & forecasting, foresight, technology intelligence, road mapping and TRIZ (The Theory of Inventive Problem Solving) analysis. All these techniques fit into a field that has come to be known as technology futures analysis (TFA). These methods have matured rather separately, with little interchange and sharing of information on methods and processes between themselves. There is a range of experience in the use of all of these, but the rapid technological changes in the recent past have prompted a need for new methods and taking advantage of information resources and new approaches to complex systems.

The objectives of the present course are to equip students with methodological tools essential for S & T planning and policy making. At the same time develop insight into impact of S & T on socioeconomic and environmental conditions and vice versa. Such analyses inform critical choices ranging from the international, regional, national level to the individual organization. These methodologies are essential for policy decisions such as setting priorities for research and development (R&D) efforts, understanding and managing the risks of technological innovation, exploiting intellectual property, and enhancing technological competitiveness of products, processes, and services. It also trains students towards future oriented thinking and for identifying desirable futures.

II. Course Outline

1. Introduction
Concepts, Approaches, Historical Perspective on Technology Assessment and Forecasting, Technological Foresight, Comparison of TATF, Foresight and TFA, Role of TFA, Relevance of TFA to the Developing Countries, Ethical Issues and Overall Socioeconomic TA
2. Major Issues
Temporal and Sectoral Dimensions, Ideological Dimensions, Boundary Conditions and Core Assumption, Validation and Public Participation
3. TATF Structures in India and Developed Countries
Changing Patterns in Private (Business Planning) and Public Sector Assessment
4. Major Techniques in Technology Assessment

- Historical Surveys, Cost-Benefit Analysis, Input/Output Analysis, System Analysis, Cross-Impact, EIA, Risk Analysis, Overall socioeconomic TA
5. Major Techniques
Normative and Exploratory Techniques: Delphi, Analogy, Growth Curves, Trend Extrapolation, Analytical Models, Breakthrough Rate, Scenario Writing, Relevance Tree, Morphological Analysis.
 7. Technology Road Mapping
Typology of Socio-Technical Transitions, Sustaining Vs. Disruptive Technologies, Complex Technology Sub-System
Typology of Roadmaps(a) product planning (b) service/capability planning (c) strategic planning; (d) long-range planning (e) knowledge asset planning (f) program planning (g) process planning; (h) integration planning
 8. TRIZ analysis (*Teoriya Resheniya Izobreatatelskikh Zadatch*)
Theory of invention: How inventors invent?., Theory of increasing ideality
 9. Technology Futures Analysis
Umbrella Concept for Multiple Methods, Multi-Actor Context, Participative Approach, Process Management, Negotiation-Oriented Approaches, Dialectic Approach

Essential Reading

- Arie Rip, Thomas Misa and John Schot (eds) (1995), *Managing Technology in Society: The Approach of Constructive Technology Assessment* (Pinter, London).
- Arnstein, S.R. and Christakis, A.N. (1976), "Perspectives on Technology Assessment", *Methodologies in Perspective*, (Science and Technology Publishers, Jerusalem).
- Ascher, William (1979), "Problems of Forecasting and Technology Assessment", *Technological Forecasting and Social Change* 13, 149-156, 1979.
- Balachandra, R. (1980), "Perceived Usefulness of Technological Forecasting Techniques", *Technological Forecasting and Social Change* 16, 155-166, 1980.
- Bowonder, B. (1979), "Appropriate Technology for Developing Countries: Some Issues", *Technological Forecasting and Social Change* 15, 55-67, 1979.
- Bowonder, B. (1979), "Impact Analysis of the Green Revolution in India", *Technological Forecasting and Social Change* 15, (4), December 1979.
- Bozeman, Barry and Rossini, Frederick A. (1979), "Technology Assessment and Political Decision making", *Technological Forecasting and Social Change* 15, 25-35, 1979.
- Chatel, Bertrand H. (1979), "Technology Assessment and Developing Countries", *Technological Forecasting and Social Change* 13, 203-211, 1979.
- Coates, Joseph F. (1976), "The Role of Formal Models in Technology Assessment" *Technological Forecasting and Social Change*, Vol. 9, 139-190, 1976.
- Coates, Vary T. and Fabian, Thecla. (1982), "Technology Assessment in Europe and Japan," *Technological Forecasting and Social Change* 22, 343-361, 1982.
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- Covello, Vincent and Menkes, Joshua (1982), "Issues in Risk Analysis", in Christopher

- Desai P. N. (1995), "Technology Assessment in the Indian Footwear Sector", *Technological Forecasting & Social Change* (Elsevier Science Inc., New York, 48, 177-187).
- Fleischer, Torsten, Michael Decker and Ulrich Fiedeler (2005), "Assessing Emerging Technologies—Methodological Challenges and the Case of Nanotechnologies", *Technological Forecasting & Social Change* 72 , pp.1112–1121.
- Fonseca, Ricardo Seidl da (ed) (2003), *Foresight Methodologies* (UNIDO, Vienna)
- Godet, Michel (2001), *Creating futures: Scenario Planning as a Strategic Management tool* (Economica Ltd., London).
- Hetman, F. (1973), *Society and the Assessment of Technology* (OECD, Paris).
- Kalam A P J and Rajan Y. S. (1998), *India 2020: A Vision for the New Millennium* (Viking, New Delhi).
- Linton, J.D. and S.T. Walsh (eds) (2004), "Roadmapping: From Sustainable to Disruptive Technologies", *Technological Forecasting & Social Change*, Vol. 7, No.1–3, pp.1-196.
- Maloney, Jr., James D. (1982), "How Companies Assess Technology," *Technology Forecasting and Social Change* 22, 321-329, 1982.
- Mayo, Louis H.(1977), *Monitoring the Direction and Rate of Social Change Through the Anticipatory Assessment Function*, (George Washington University Program of Policy Studies in Science and Technology, Washington, D.C., July 1977).
- Menkes, Joshua (1979), "Epistemological Issues of Technology Assessment," *Technological Forecasting and Social Change* 15, 11-23, 1979.
- O'Brien, David M.and Marchand, Donald (eds.)(1982), *Politics of Technology Assessment: Institutions, processes and Policy Disputes* (Lexington Books, D.C. Heath and Company, Lexington, Mass.).
- Phaal, Robert; Clare J.P. Farrukh and David R. Probert (2004), "Technology roadmapping—A planning framework for evolution and revolution", *Technological Forecasting & Social Change*, 71, pp.5–26
- Porter Alan L., Brad Ashton et al (2004), "Technology Futures Analysis: Toward integration of the field and new methods", *Technological Forecasting & Social Change* Volume 71, Issue 3, pp. 287-30.
- Rajan Y. S. (1997), "The Institutional Aspects of Technology Assessment", *Workbook for Training in Environmental Technology Assessment for Decision – Making – A Pilot Programme* (UNEP, 1997)
- Ramanujam, Vasudevan and Saaty, Thomas L. (1981), "Technological Choice in the Less Developed Countries: An Analytic Hierarchy Approach, "*Technological Forecasting and Social Change* 19, 81-98 1981.
- Rescher, Nicholas. (1981), "Methodological Issues in Science and Technology Forecasting : Uses and Limitations in public Policy Deliberations," *Technological Forecasting and Social Assessments* (University of California, Berkley September.
- Rohatgi, K.and Rohatgi, P.K. (1979), "Delphi as a Tool to Identify Future Appropriate Technologies in India," *Technological Forecasting and Social Change* 14, 65-76, 1979.
- Rohatgi, Pradeep (1982), *Environmental Dimensions in Technology Assessment for Industrial Development: The Case Study of India* (United Nations Environment Programme, UNEP/WA.809/3 19 October 1982, Seminar on Environment Aspects of Technology Assessment, Geneva, 29 November - 4 December 1982).
- Smith, Adrian et al (2005), "The Governance of Sustainable Scio-Technical Transitions", *Research Policy* 34, pp. 1491-1510.

Stone, Harold A. and Turoff, Murray (eds.) (1975), *The Delphi Method: Techniques and Applications* (Addison-Wesley Publishing Company, Advanced Book Program, Reading, Massachusetts).

Important Journals

1. *Technology Forecasting and Social Change*
2. *International Journal for foresight and Innovation Policy*

Important links

1. TIFAC
<http://www.tifac.org.in/>
2. Policy Research in Engineering, Science and Technology (PREST)
<http://www.mbs.ac.uk/research/centres/engineering-policy>
3. Science Policy Research Unit, Sussex
<http://www.sussex.ac.uk/spru/>

Recommended Reading

- Ayres, Rober U. (1969), *Technology Forecasting and Long-Range Planning* (New York: McGraw-Hill).
- Bowonder, B. (1981), "Environmental Risk Assessment Issues in the Third World", *Technological Forecasting and Social Change* 19, 99-127, 1981.
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- Mitroff, Ian I. (1982), "The Philosophy of Modeling and Futures Research: A Guide to Different Models," *Technological Forecasting and Social Change* 21, 267-280, 1982.
- OTA (1994), *Perspectives on the Role of Science and Technology in Sustainable Development* (OTA, Washington D. C., September 1994)
- OTA (1995), *Innovation and Commercialization of Emerging Technologies* (OTA, Washington D. C., September 1995)
- Porter, Alan L., Rossini, F.A.Carpenter, S.R. and Roper, A.T.A (1980). *Guidebook for Technology Assessment and Impact Analysis* (North-Holland, New York).
- Porter, Alan and Rossini, F.A. (1983), *Integrated Impact Assessment* (Westview Press Boulder, Co).
- Smits, R. Leyton, J. and Den Hertog, P.(1995), "Technology Assessment and Technology Policy in Europe: New Concepts, New Goals, New Infrastructures", *Policy Sciences* (Vol. 28, No. 3, August 1995), pp. 271-299.
- Stone, Harold A. et al (1979), "The Use of Structural Modeling for Technology Assessment," *Technological Forecasting and Social Change* 14, 291-327, 1979.
- TIFAC, *Technology Vision 2020 Reports* (TIFAC, Department of Science and Technology, New Delhi).