Technological Innovation Studies Program

Research Report

COMMENTS ON THE COURSE,
MANAGEMENT OF CREATIVITY AND INNOVATION
by

George F. Farris
Faculty of Administrative Studies
York University
February, 1979.

Rapport de recherche

Programme des études sur les innovations techniques

Industry, Trade and Commerce
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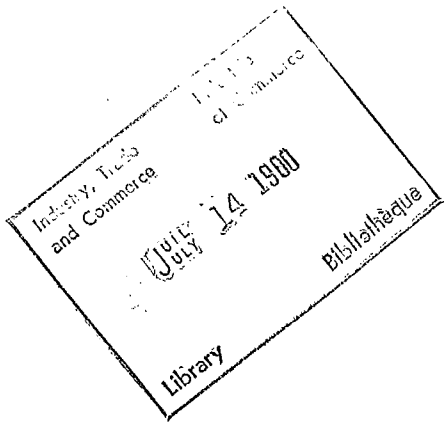

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Comments on the Course, "Management of Creativity and Innovation"

George F. Farris

The course, "Management of Creativity and Innovation," was offered for the first time during the Fall 1978 semester at York University. The outline for the course is attached together with lists of Canadian and recent international references discovered during development of the course. The comments below are divided into four areas: a description of the course, an evaluation of the course by the students and professor, suggested changes in the course format, and a list of cautions for anyone else wishing to offer a similar course in Canada.

THE COURSE

The thirteen-week course was divided into three major sections: I. Individual Creativity and Entrepreneurship, II. Organization Climate for Invention, and III. Strategy, Structure, and Organization Innovation. A list of topics and readings in each section appears in the course outline. The three-hour classes consisted of a variety of activities including lecture-discussions, case analyses, guest lecturers, and reports of student research on innovation in Canadian organizations. Students were asked to prepare three papers: a critical review of a book on some aspect of innovation, a term paper on individual creativity, and a term paper on project management or organizational innovation. The term papers could be either empirical studies of Canadian organizations or integrative reviews of a body of literature. The course outline details the assignments.

The term papers covered a variety of topics of interest to managers of innovation in Canadian organizations. Library research topics included technology transfer, techniques for enhancing creativity, and the dual ladder. Empirical studies included a comparison of the organization climate in the Ontario Research Foundation and the Max Planck Institute (West Germany), a comparison of the organization structures of SPAR Aerospace and DuPont Canada Ltd.'s development laboratories, and a study of retrenchment efforts in the research department of a Canadian resource company.

Guest lecturers included Dr. Alan Pearson, editor of the journal R & D Management and professor at the University of Manchester; Professor Russell Blackmore of York University's Management Science area; William Munns, Chief Chemist at Canada Packers; James Cowley, independent inventor; and Thomas Clarke of ITC.

Thirty-four students took the course, including about twenty-five who attend York part time while working during the day. Three were doctoral students in Administrative Studies, two were graduate students in other departments at York, and the remainder were enrolled in York's M.B.A. Programme. Several students were currently working in high-technology Canadian organizations, and several others worked in other organizations which employed "knowledge workers" doing potentially innovative work. A few of the students were concentrating in the Arts Administration Programme, and several others were especially interested in entrepreneurship and management of small businesses.

EVALUATION

All courses in Administrative Studies at York University are evaluated

by students on an anonymous thirty-item questionnaire which also asks students to report what they liked best and least about the course and changes they would suggest. Of thirteen courses in the Behavioural Science Area during Fall 1978 "Management of Creativity and Innovation" received the highest overall evaluation. Students liked nearly all major aspects of the course equally well -- the lectures, readings, term papers, and professor. A few felt that too much reading was assigned, and some wished that there had been less emphasis on technological innovation and more on innovation in arts organizations, probably reflecting their particular interests. The professor's expertise in the subject matter of the course was frequently mentioned as an important positive factor.

The instructor was also very pleased with this first offering of the course. Rough edges inherent in new courses certainly were present, especially in some of the reading assignments. No single affordable text was found, but the three books employed were quite successful. Despite the extensive search for appropriate Canadian material, not enough articles and cases were found on many topics of the course. Note that the attached Canadian references heavily emphasize problems of national science policy and contain few articles on management per se. Library collections at York contain only a fraction of the books and periodicals relevant to course topics; thus, students were forced to use facilities at neighbouring universities for some of their work.

SUGGESTED CHANGES

The course will be offered again next fall. Currently, it is planned to follow the same basic format used so successfully during the first offer-

ing. The reading list will be shortened somewhat, and slightly more emphasis will be given to entrepreneurship. Further efforts will be made to incorporate some of the Canadian material discovered but not used last year, and a search for new material will be conducted. It should be noted, however, that not one student commented upon the Canadian content of the course, positively or negatively, either on material which was included or stating a desire for more material to be included. Apparently, many of the factors involved in management of creativity and innovation, as opposed to national policy, are relatively universal in different countries. Students themselves are a major source of Canadian content.

CAUTIONS

The success of this course at York suggests that similar courses could be offered elsewhere in Canada. Several cautions are in order for anyone wishing to do so.

1. The basic outline of the course is a good starting point for other courses. However, the specific content and emphasis should be attuned not only to the interests of the students but also to the strengths and weaknesses of the professor. Of the many factors important to the management of creativity and innovation in Canada, only some of them can be covered thoroughly in a one-semester course.

2. A course like this one helps bridge the gaps between universities and industry and government. Not only do working students bring their experience to the classroom; the field-research term papers also transfer some academic management ideas outside the universities. A few guests from industry and government can add much to this bridging process.

3. A number of the research projects currently being completed with support from the University Grants Programme of ITC can potentially provide

Canadian material useful in the course as their findings are published in the next year or so. The Director of the Programme should be consulted for reference to such material.

4. The course need not be offered in its entirety. Parts of it can be used for shorter courses or combined with other material for a longer course. For example, discussions are now underway with the Director of the York Executive Programmes about offering a short seminar based on course material.

5. Finally, the author will be more than willing to discuss the course with anyone who wishes to offer a similar one elsewhere in Canada. Technological innovation and its management are too important to Canada to be absent from university curricula in the future.

Fall, 1978

BEHS 621. MANAGEMENT OF CREATIVITY AND INNOVATION

Professor George F. Farris

325A A.S.B., X3711

This course examines factors which stimulate and inhibit individual and group creativity in organizations and its translation into innovative output by the organizations. Emphasis is placed on the management of research and development, but the role of other parts of the organization is considered as well. The course is divided into three major sections: individual creativity and entrepreneurship, organizational climates for stimulating invention, and organizational strategies and structures for innovation.

BOOKS - Required:

Watson, James, D. The Double Helix. Signet (New American Library) 1968.

Pelz and Andrews, Scientists in Organizations. Institute for Social Research, University of Michigan, 1976.

Freeman, Chris Economics of Industrial Innovation. Penguin, 1974.

Supplementary:

Allen, T. Managing the Flow of Technology, MIT Press, 1977.

Gerstenfeld, A. Innovation: A Study of Technological Policy, University Press of America, 1977.

Kaufman, H. G., Obsolescence & Professional Career Development, AMACOM, 1974.

Kelley & Kranzberg, Eds., Technological Innovation: A Critical Review of Current Knowledge, San Francisco Press, Inc., 1978.

Taylor, Irving, A. & Getzels, J. W. Perspectives in Creativity, Aldine Publishing, 1975.

Twiss, Brian Managing Technological Innovation, Longman, 1974.

Zuckerman, Harriet Scientific Elite: Nobel Laureates in the U.S., The Free Press (MacMillan), 1977.

Supplementary books should be available in limited quantities in both the EAS Library and the bookstore, except for the Kelley & Kranzberg book which is on library reserve only.

Individual copies of numerous articles will also be handed out in class.

PAPERS

Three written assignments will be required: a book review, a paper on individual creativity, and a paper on project management or organizational innovation.

1. Book review. A five-page critical evaluation of one book (or two related books) is due October 6. Possibilities include books listed in the supplementary readings and references listed in the assigned readings. The only restriction is that the book be about the subject matter of the course.

2. Individual Creativity. A ten-twelve-page paper on some aspect of individual creativity in organizations is due November 6. This paper may be co-authored by up to three persons. It may be either an empirical study involving interviews with a number of persons doing potentially creative work or a library research paper which provides an original integration of a body of research on a specialized topic. A one-page outline of the paper should be submitted October 13.

3. Project Management/Organizational Innovation. A ten-twelve-page paper on some aspect of project management or organizational innovation is due December 4. This paper may be co-authored by up to three persons. It may be either a library research paper which provides an original integration of a body of research on a specialized topic or an empirical study using interviews with persons involved in the management of a project or making decisions about an organization's strategies for innovation. A one-page outline of the paper should be submitted November 13.

Examples of possible topics for the individual creativity paper include theories of creativity, techniques to enhance creativity, career management for the professional, management practices related to turnover or job satisfaction of potentially creative employees, technical communication, informal organizations among professionals, the dual ladder, etc. An empirical paper would focus on the experiences of several individuals with the topic under consideration; a library research paper would review literature on the topic and integrate it to assess the state of the art on the topic.

Examples of possible topics for the project management/organizational innovation paper include project selection techniques, technological forecasting, project management techniques, organization designs to integrate projects with the rest of the organization, comparison of successful and unsuccessful attempts at innovation, ways R & D budgets are actually determined, some aspect of technology transfer, some aspect of science policy, etc. An empirical paper would focus on the experiences of one or more projects or organizations; a library research paper would review literature to assess the state of the art on the topic.

Utterback's (1974) Science article is an excellent example of a library research paper, and Howton's (1963) ASQ article is an excellent example of an empirical study. (Each, of course, attains standards beyond those expected in a 10-12 page term paper!)

JOURNALS AND BOOKS

Besides the usual management and organizational behavior journals, articles on the management of creativity and innovation frequently appear in the following publications in the York library system.

IEEE Transactions on Engineering Management (1966-78) Steacie Library)

Research Management (1967-78) (Admin. Studies Library)

Research Policy (1971-78) (Admin. Studies Library)

The following are not currently available in the FAS Library at York. However, they may be obtained at the University of Toronto's Engineering Library.

Research Management (1960-66)

IEEE Transactions and Engineering Management (1962-66)

R & D Management (1971-78)

Books on the subject of the course are often listed under headings of creativity and technological innovations in the Library at York. The above libraries have a number of books on the subject as well as journals.

SCHEDULE

I Individual Creativity and Entrepreneurship

Sept. 8. 1. Introduction: Creativity, Invention, and Innovation in Canada

Read:

Shepherd, J. "Canadian Industrial Strategy". From The Dean's Colloquium Series 1977-78 "Threats & Opportunities for Can. Enterprise".

Farris, George F. "Motivating R & D Performance in a Stable Organization. In Kaufman, H. (ed.): Career Management: A Guide to Combating Obsolescence, New York: I.E.E.E. Press, 1975, 101-106.

Kerr, S., Von Glinow, M. A., & Schriesheim, J. "Issues in the Study of "Professionals" in Organizations: The Case of Scientists and Engineers". Organizational Behavior & Human Performance, 1977, 18, 329-345.

Mini Cases from Gerstenfeld, A.: Innovation: A Study of Technological Policy. Washington, D. C.: University Press of America, 1977, pp. 179-182*, 183-190**, 191-196***.

Case Study 1 - The $100-Million Object Lesson*
Case Study 2 - International Production Technology, Inc.**
Case Study 3 - Innovation at Texas Instruments***

Sept. 11 2. Explaining Scientific Achievement

Read: Watson, The Double Helix

McClelland, D. C. "On the Psychodynamics of Creative Physical Scientists". In Gruber, H. E. (ed.): Contemporary Approaches to Creative Thinking, New York: Atherton Press, 1963, 141-174.

Rogers, Carl, R. "Toward a Theory of Creativity". In Anderson, H. H. (Ed.): Creativity and Its Cultivation, New York: Harper and Row Publishers, 1959, 69-82.

Newell, A., Shaw, J. C., & Simon, H. A. "The Processes of Creative Thinking". In Gruber, H. E. (ed.): Contemporary Approaches to Creative Thinking, New York: Atherton Press, 1963, 63-119.

Sept. 18 3. Theories of Creativity

Read:

Taylor, Irving, A. "A Retrospective View of Creativity Investigation". In Taylor, I. A. & Getzels, J. W.: Perspectives in Creativity, Chicago: Aldine Publishers, 1975, 1-36.

Guilford, J. P. "Creativity: A Quarter Century of Progress". In Taylor, I. A. & Getzels, J. W.: Perspectives in Creativity, Chicago: Aldine Publishers, 1975, 37-59.

Maddi, Salvatore, R., "The Strenuousness of the Creative Life". In Taylor, I. A. & Getzels, J. W.: Perspectives in Creativity, Chicago: Aldine Publishers, 1975, 173-190.

Getzels, J. W. "Creativity: Prospects and Issues". In Taylor, I. A. & Getzels, J. W.: Perspectives in Creativity, Chicago: Aldine Publishers, 1975, 326-344.

Getzels, J. W. & Jackson, P.W. "The Highly Intelligent and Highly Creative Adolescent: A Summary of Some Research Findings". In Taylor, C. W. & Barron, F. (eds.); Scientific Creativity: Its Recognition and Development, New York: John Wiley & Sons, 1963, 161-172.

Class: Guest - Prof. Blackmore "Creativity and the Brain"

Sept. 25 4. Applications: Techniques, Management, Entrepreneurship

Read:

Techniques:

Souder, W. E. & Ziegler, R. W. "A Review of Creativity and Problem Solving Techniques". In Research Management, July, 1977,

Sept. 25 (cont'd)

Lewis, A. C., Sadosky, T. L., & Connolly, T. "The Effectiveness of Group Brainstorming in Engineering Problem Solving". In IEEE Transactions on Engineering Management, Vol. Em-22, No. 3, August 1975, 119-124.

Management:

Pelz & Andrews: 154-173 "Creativity"
337-366 "Creative Process"

Entrepreneurship:

Litvak, I. A. & Maule, C. J. "Profiles of Technical Entrepreneurs". The Business Quarterly, The University of Western Ontario, School of Business Administration, Summer, 1974, 40-49.

Short cases on Candian Entrepreneurs:

Hutchison, M. "A terminal case with a happy ending. Canadian Research, April, 1978, 25, 28, 33.

O'Keefe, J. "The future holds nothing but good vibes for Vibron". In Canadian Research, Sept.-Oct. 1977, 36-38, 40, 42.

O'Keefe, J. "Taking on the giants in RIA at 26". Canadian Research, May, 1978,

O'Keefe, J. "The chemical plant that started in a shed". Canadian Research, June 1978, 43, 44, 46, 47.

Class: RAT test
Skills practice

II Organization Climate for Invention

Oct. 6 5. Work Planning

BOOK REVIEW DUE

Read:

Pelz & Andrews: xv-xxviii, "Creative Tensions"
1-7 "Researching the Scientist"
321-336 "Problem Solving vs. Decision Makers"
54-79 "Diversity"
367-382 "Time Pressure"

McCarrey, M. W. & Edwards, S. A. "Organizational Climate Conditions for Effective Research Scientist Role Performance". In Organizational Behavior and Human Performance, 1973, 9, 439-459.

Andrews, F. M. "Diversity and Scientific Performance: Results From USA and Six European Nations". Prepared for presentation at the 1977 Annual Convention of the American Sociological Association.

Oct. 6 (Cont'd)

Howton, F. W. "Work Assignment and Interpersonal Relations in a Research Organization: Some Participant Observations". Administrative Science Quarterly, 1963, 7, 502-520.

Class: Mini-Questionnaires,
Guest: Alan Pearson, Editor, R & D Management

Oct. 13 6. Technical Communications

OUTLINE OF TERM PAPER 1 DUE

Read:

Pelz & Andrews: 35-53 "Communication"

Allen, T. J. & Cohen, S. I. "Information Flow in Research and Development Laboratories". Administrative Science Quarterly, 1969, 14, 12-19.

Tushman, M. L. "Special Boundary Toles in the Innovation Process". Administrative Science Quarterly, December 1977, 22, 587-605.

Holland, W. E. "Characteristics of Individuals with High Information Potential in Government Research and Development Organizations". IEEE Transactions on Engineering Management. Vol. EM-19, No. 2, May 1972, 38-44.

Keller, T. T. & Holland, W. E. "Individual Characteristics of Innovativeness and Communication in Research and Development Organizations". Journal of Applied Psychology, in press.

De Solla Price, D. J. & Beaver, D. B. "Collaboration in an Invisible College". American Psychologist, 1966, 1011-1018.

Marquis, D. G. & Allen, T. J. "Communication Patterns in Applied Technology". American Psychologist, 1966, 1052-1060.

Oct. 16 7. Career and Reward Systems

Read:

Pelz & Andrews: 80-89 "Dedication"
90-111 "Motivations"
112-139 "Satisfactions"
174-199 "Age"
200-213 "Age and Climate"

Thompson, P. H. & Dalton, G. W. "Are R&D Organizations Obsolete?" Harvard Business Review, Nov.-Dec. 1976, 105-116.

Oct. 16 (continued)

Farris, G. F. "A Predictive Study of Turnover". Personnel Psychology, 1971, 24, 311-328.

Shepard, H. A. "The Dual Hierarchy in Research". Administering Research & Development, 19 , 425-432.

Research Management Symposium on the Dual Ladder:

Ritti, R. R. "Dual Management - Does it Work?". In Kaufman, H. (ed.): Career Management: A Guide to Combating Obsolescence, New York: I.E.E.E. Press, 1975, 367-374.

Moore, D. C. & Davies, D. S. "The Dual Ladder - Establishing and Operating It". Research Management, July, 1977, 14-19.

Smith, J. J. & Szabo, T. T. "The Dual Ladder - Importance of Flexibility, Job Content & Individual Temperament". Research Management, July, 1977, 20-23.

Meisel, S. L. "The Dual Ladder - The Rungs and Promotion Criteria". Research Management, July, 1977, 24-33.

Cantrall, E. W. "The Dual Ladder - Successes and Failures". Research Management, July, 1977, 30-33.

Class: Performance Appraisal Case

Oct. 23 8. Leadership, Supervision, Group Dynamics

Read:

Pelz & Andrews: 8-33, 140-153, 240-260, 383-401

Farris, G. F. "The Technical Supervisor: Beyond the Peter Principle". In Kaufman, H. (ed.): Career Management: A Guide to Combating Obsolescence, New York: I.E.E.E. Press, 1975, 107-114.

Farris, G. F. "Organizing Your Organization". Innovation, 1971, #25, 2-11(b).

Conrath, D.W. "The Role of the Informal Organization in Decision Making on Research and Development". I.E.E.E. Transactions on Engineering Management, Vol. EM-15, No. 3, Sept. 1968, 109-119.

Class: Case or film - The Bob Knowlton Story

III Strategy, Structure, and Organizational Innovation

Nov. 6 9. Success & Failure in Organizational Innovation

TERM PAPER 1 DUE

Read: Freeman, chapters 1-6, especially ch. 5, "Success and Failure in Industrial Innovation"

Marquis, D. G. "The Anatomy of Successful Innovations". From a monograph published by the National Science Foundation "Successful Industrial Innovations" by Myers & Marquis (available from Superintendent of Documents, GPO, Washington, D.C., $1.00).

Utterback, J.M., Allen, T.J., Hollomon, J.H., & Sirby, Jr., M.A. "The Process of Innovation in Five Industries in Europe and Japan". IEEE Transactions on Engineering Management, Vol. EM-23, No.1, Feb., 1976, 3-9.

Hippel, Eric von, "The Dominant Role of Users in the Scientific Instrument Innovation Process". Research Policy, 5, 1976, 212-239.

Ibuka, M. "How SONY Developed Electronics for the World Market". IEEE Transactions on Engineering Management, Vol. #M-22, No. 1, Feb., 1975, 15-19.

Nov. 13 10. Technology Strategy

OUTLINE OF TERM PAPER 2 DUE

Read: Freeman, ch. 8 "Innovation and the Strategy of the Firm".

Roberts, E. B., "Technology Strategy for the Medium-Size Company". Research Management, July 1976, 29-32.

Baker, N. R. & Sweeney, D. J. "An Assessment of Modeling Capability Related to the Process of Organized Technological Innovation Within the Firm". Jan. 1978, Vol. 1: Executive Summary NSF GRANT, RDA 75-17332 University of Cincinnati, College of Business Administration.

Mansfield, E. & Brandenburg, R. "The Allocation, Characteristics, and Outcome of the Firm's Research and Development Portfolio: A Case Study". The Journal of Business, Oct. 1966. 4, 447-464.

Twiss, Brian "Strategies for Research and Development". Managing Technological Innovation, London: Longman, 1974, 26-65.

Case: The ABC Engineering Company: Innovative Management in Canada Innovation Canada, 1976.

Nov. 20 11. Project Selection and Management

Read: Freeman, ch. 7 "Uncertainty, Project Evaluation and Innovation"

Clarke, T. E. "Decision-making in Technologically Based Organizations: A Literature Survey of Present Practice". IEEE Transactions on Engineering Management, Vol. EM-21, No. 1, February, 1974., 9-23.

Norris, K. P., "The Accuracy of Project Cost and Duration Estimates in Industrial R & D". R&D Management, 2, 1, 1971, 25-36.

Twiss, Brian "Technological Forecasting for Decision Making". Managing Technological Innovation, London: Longman, 1974, 66-94.

Twiss, Brian "Project Selection and Evaluation". Managing Technological Innovation, London: Longman, 1974, 119-147.

Case: Higgins Equipment Co. B.

Nov. 27 12. Organization Design for Innovation

Read: Pelz & Andrews, . 12

Twiss, Brian "Organization for Innovation". Managing Technological Innovation, London: Longman, 1974, 204-233.

Marquis, D. "Ways of Organizing Projects". Innovation, 1969, #5, 1-4.

Morton, J.A. "The Innovation of Innovation". IEEE Transactions on Engineering Management, Vol. EM-15, No. 2, June 1968, 57-65.

Mordka, I. "A comparison of a Research and Development Laboratory's Organization Structures". IEEE Transactions on Engineering Management, Vol. E.M.-14, No. 4, Dec. 1967, 170-176.

Frohman, A. L. "Critical Functions for an Innovative R&D Organization". The Business Quarterly, Winter 1974, 72-81.

Farris, G. F. "Informal Organizations in Research and Development". Paper prepared for presentation in session "Behavioral Research on the Management of Innovations: A Critical Review, & Managerial Implications." Joint National Meeting of Institute of Management Sciences & Operations Research Society of America, New York, May, 1978.

Roberts, E. B. & Frohman, A. L. "Internal Entrepreneurship: Strategy for Growth". Business Quarterly, 1972, 37, 71-78.

Dec. 4. 13. Technology Transfer and Diffusion; Science Policy

TERM PAPER 2 DUE

Read:

Freeman, Ch. 9 "Aspects of Public Policy for Innovation".

Utterback, J. M. "Innovation in Industry and the Diffusion of Technology". Science, Vol. 183, Feb. 1974, 620-626.

Globerman, S. "Technological Diffusion in the Canadian Carpet Industry". Research Policy, 1975, 4, 190-206.

Orr, John, L. "A New Research Policy for Canada: MOSST Flies some Kites". Canadian Research, June, 1978, 16-18.

Souder, W. E. & Chakrabarti, A. K. "Government Influence and Industrial Innovation". Industrial Marketing Management, 1978, 7, 17-25.

Globerman, S. "Canadian Science Policy and Economic Nationalism". See Gov. of Canada: A Science Policy for Canada, Vols. I & II from Governmental Policies for the Support of Research and Development.

Wilson, H. T. "Attitudes Towards Science: Canadian & American Scientists". International Journal of Comparative Sociology, XVIII, 1-2.

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SURVEYED FOR BEHS 621 V.

B. E. C. Boothman

Faculty of Administrative Studies.

Research Policy.

Globerman, S. "Technological Diffusion in the Canadian Carpet Industry," v. 4, No. 2, (April, 1975), p. 190-206.

Inhaber, H. "The Leading Edge of Science in Canada," v. 7, No. 1, (January, 1978), p. 88-98.

Wilson, A. H. "Canadian Science Policy: Report Number Four Revisited," v. 3, No. 2, (April, 1974), p. 202-215.

Unpublished.

Daly, D. J. "Canada's Comparative Advantage." Unpl. York University, 1977.

Shepherd, J. "Canadian Industrial Strategy: Threats and Opportunities for Canadian Enterprise." Unpl. York University, 1977.

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Business Quarterly.

Grimley, S. S. "Canadian Factors in the Generation and Evaluation of New Product Ideas," v. 39, No. 2, (Summer, 1974), p. 32-39.

Litvak, I. A., and C. J. Maule. "Profiles of Technical Entrepreneurs," v. 39, No. 2, (Summer, 1974), p. 40-49.

Canadian Research and Development.

O'Keefe, J. "The Future Holds Nothing But Good Vibes for Vibron," v. 7, No. 5, (Sept-Oct., 1977).

O'Keefe, J. "Taking on the Giants in RIA at 26," v. 8, No. 3, (May, 1978).

O'Keefe, J. "The Chemical Plant That Started in a Shed," v. 8, No. 4, (June, 1978).

IEEE Transactions on Engineering Management.

Litvak, I. A., and C. J. Maule. "Some Characteristics of Successful Technical Entrepreneurs in Canada," v. EM-20, No. 3, (August, 1973), p. 62-68.

Minerva.

Doern, G. B. "'Big Science,' Government and the Scientific Community in Canada: The IHG Affair," v. 8, No. 3, (July, 1970), p. 357-375.

Globerman, S. "Canadian Science Policy and Economic Nationalism," v. 14, No. 2, (Summer, 1976), p. 191-208.

Grosart, A. "Canadian Science Policy," v. 9, No. 4, (October, 1971), p. 538-544.

Grubel, H. G. "Reflections on the Present State of the Brain Drain and a Suggested Remedy," v. 14, No. 2, (Summer, 1976), p. 209-224.

Johnson, H. G. "Comments on Senator Grosart's Paper," v. 9, No. 4, (October, 1971), p. 544-547.

Research Management.

Drury, C. E. "Government Stimulation of Technical Innovation by Canadian Industry," v. 11, No. 2, (March, 1968), p. 93-100.

Showalter, H. A. "Government Support of Industrial Research and Development in Canada," v. 10, No. 1, (Jan., 1967), p. 51-60.

SCIENCE COUNCIL OF CANADA

_____. A Space Program for Canada. Background Report No. 1, (1967).

_____. The Proposal for an Intense Neutron Generator: Initial Assessment and Recommendation. Background Report No. 2, (1967).

_____. A Major Program of Water Resources Research in Canada. Background Report No. 3, (1968).

_____. Towards a National Science Policy in Canada. Background Report No. 4, (1968).

_____. University Research and the Federal Government. Background Report No. 5, (1969).

_____. A Policy for Scientific and Technical Information Dissemination. Background Report No. 6, (1969).

_____. Earth Sciences Serving the Nation: Recommendations. Background Report No. 7, (1970).

_____. Canada, Science and the Oceans. Background Report No. 10, (1970).

_____. A Canadian STOL Air Transport System—A Major Program. Background Report No. 11, (1970).

_____. A Trans-Canada Computer Communications Network: Phase I of a Major Program on Computers. Background Report No. 13, (1971).

_____. Cities for Tomorrow: Some Applications of Science and Technology to Urban Development. Background Report No. 14, (1971).

_____. Innovation in a Cold Climate: The Dilemma of Canadian Manufacturing. Background Report No. 15, (1971).

_____. Lifelines: Some Policies for Basic Biology in Canada. Background Report No. 17, (1972).

_____. Policy Objectives for Basic Research in Canada. Background Report No. 18, (1972).

_____. Canada, Science and International Affairs. Background Report No. 20, (1973).

_____. Strategies of Development for the Canadian Computer Industry. Background Report No. 21, (1973).

_____. Science for Health Services. Background Report No. 22, (1974).

BOOKS.

Daly, D. J., and S. Globerman. Tariff and Science Policy: Applications of a Model of Economic Nationalism. Toronto: Ontario Economic Council, 1976.

Doern, G. B. Science and Politics in Canada. Montreal: McGill-Queen's University Press, 1972.

Hayes, F. R. The Chaining of Prometheus: Evolution of a Power Structure for Canadian Science. Toronto: University of Toronto Press, 1973.

Innovation Canada. Proceedings of the Sixth Innovation Canada Seminar. Mississauga: Innovation Canada, 1976.

Lamontagne, M. A Science Policy for Canada: Report of the Senate Special Committee on Science Policy. 3 v. Ottawa: Information Canada, 1970, 1972, 1973.

Lithwick, N. H. Canadian Science Policy and the Economy. Toronto: Methuen, 1968.

Little, B. The Right New Product. London: University of Western Ontario, 1974.

Cordell, A. J. The Multinational Firm, Foreign Direct Investment, and Canadian Science Policy, (1971).

Bourgault, P. L. Innovation and the Structure of Canadian Industry, (1972).

Wilson, A. H. Governments and Innovation, (1973).

Boyd, A. D., and A. C. Gross. Education and Jobs: Career Patterns Among Selected Canadian Science Graduates With International Comparisons, (1973).

Boyd, A. D., and A. H. Wilson. Technology Transfer in Construction, (1975).

Cordell, A. J., and J. M. Gilmour. The Role and Function of Government Laboratories and the Transfer of Technology to the Manufacturing Sector, (1976).

_____. Technology Transfer: Government Laboratories to Manufacturing Industry. Background Report No. 24, (1976).

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1.	I.A. Litvak C.J. Maule	Department of Economics, Carleton University.	Canadian Entrepreneurship: A Study of Small Newly Established Firms. (October 1971)
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7. J.W.C. Tomlinson	Faculty of Commerce and Business Administration, University of British Colombia.	Foreign Trade and Investment Decisions of Canadian Companies. (March 1973)
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