# REVIEW OF EDUCATIONAL MATERIAL RELEVANT TO THE UTILIZATION OF RESEARCH RESULTS IN THE THIRD WORLD

A report prepared for IDRC's Communication Division

by

Dr. J. André Potworowski

Senior Policy Advisor

Ottawa
February 1990

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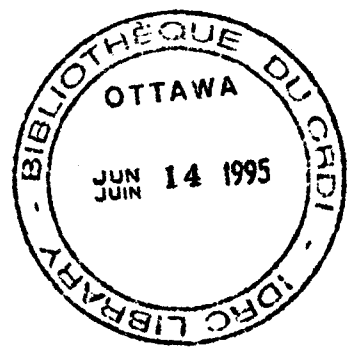

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## Educational Material on Utilization

Overview:

IDRC, as a major sponsor of research activities in the third world, has been interested for some time in approaches to increase the utilization of the research that it sponsors. One such approach is training of research managers and others involved in the utilization process. This report presents a selected sample of educational material available on the utilization of research results.

As such there are few if any courses that teach this specific subject. Only one program, that of the Research Management Centre in the Philippines, offers a series of courses that could be relevant to utilization of research results in the third world, including research management. Many courses listed here include some aspect of it, even those that are directed to technology in corporations in industrialised countries. One can create a composite picture of what such a course might look like by carefully selecting elements of a variety of courses on technology transfer, technology management, industrial marketing, technology policy, and communications.

As a first step to developing such a course, this report reviews some of the factors that would influence the design of such a course, including regional and cultural context, and sphere of economic activity. This report also includes close to thirty outlines and summaries of courses on related topics offered in North America, Europe and Asia. The selection of these outlines is clearly not comprehensive, or for that matter representative, but it does give a good indication of the scope of available material. A key issue that will have to be addressed is the degree to which the analytical frameworks and concepts in these courses can be transferred successfully to such different contexts as South East Asia, West Africa, or Latin America.

Using research results more effectively

Research is a small but critical tool for achieving development in third world countries. Currently, annual expenditures on third world research activities are estimated to be around $15 billion (IDRC Searching). Given the climate of fiscal restraint prevalent in many foreign aid donor agencies, it is important to extract maximum benefit from this investment. One way of achieving this is to improve the effectiveness of the process with which research results are used. This is a major challenge to research institutions in developing countries, as well as to donor agencies.

There is no overall picture available as to how other donor agencies perceive this challenge, nor what initiatives they have already taken. IDRC, however, has adopted a policy that would increase the probability of having research results used in its Program and Policy Review no. X (IDRC PPR X). The Swedish SAREC has also expressed its concern over the utilization of research results (SAREC 1989).

The challenge is to devise strategies which would increase the efficiency of the research system for maximum impact on development. Appropriate strategies for donor agencies, such as IDRC have already been discussed, particularly in terms of a framework for projects that would aid in devising utilization strategies (JAP 1989).

Helping recipients become more market-oriented: an integrated approach

Not much has been done, however, to strengthen the capability of recipient agencies for having the results of their research used more effectively. It is worthwhile to review some of the mechanisms by which this could be achieved.

A good example would be the case of a West African country, which recently approached IDRC to review the capability of its thirty research institutes to be relevant to their respective clientèles. This will be done first by a survey of the institutes, and would be followed by a three-to-four day workshop, to discuss ways in which these institutes could improve their marketing and dissemination skills. This is the nature of the proposal received by IDRC.

What could be the follow-up to such a workshop? How can change be implemented, to increase that country's ability to carry out relevant research and have it used to contribute more effectively to development?

Assuming there is the political will at the top, then a number of steps can be considered, which in effect would form an integrated strategy. First, one would have to review the

mandates of each institution, to make sure that responsibility for diffusion and marketing is clearly incorporated. A good example of a recent change in the legal mandate of an institution, to make it more market-oriented, is the December 1989 Presidential decree that amended the charter of the University of Yaoundé in Cameroun. The new mandate includes specific reference to "valorization de la recherche" (see Appendix A).

The next step is to create a favourable climate to encourage utilization. This might include an incentive system for researchers in a university or a centre, including rewards through tenure and promotion, based on their ability and performance in producing and marketing research that is useful to end-users.

Another step would be to build appropriate institutional linkages, starting with the research organization, through key intermediary organizations, all the way to the end users, and involve the latter in the research. Yet another step would be to create the right fiscal incentives to encourage investors to promote an support innovations.

As one looks into specific sectors, such as agriculture, social and policy research, or health research, one can devise more detailed strategies to ensure a closer and more relevant link between research establishments, and end-user communities relevant to that particular sector. In some cases, such as the dissemination of oral rehydration treatment or family planning methods, there is also the scope for special campaigns to change users' attitudes and behaviour. One way of achieving this is through techniques of social marketing, and a good review of the area and its limitations was recently completed by Neill McKee (McKee 1989).

Training for utilization

At one point, going back to our West African case, we have to address the need for training people. This would include the training of researchers to make them aware that research does not end with the research project, but that there are many steps beyond that before the research results can have an impact; the training of research managers in the skills of devising strategies for creating favourable environments in their laboratories or research centres for the generations of relevant innovations, as well as in building bridges to the appropriate institutions which will transform the innovation into a usable technology or an implementable policy; and also the training of government planners and policy makers in the importance of managing the utilization system for maximum benefit to the country. In brief, training can have a critical role, in our West African country, in creating the right vocabulary to discuss, change attitudes, and bring about a more effective use of research results and accelerate the required process of organizational renewal. Obviously, training on its own will have a limited impact.

The bibliographic survey on utilization reveals quite clearly that the topic has been researched for several decades in industrialized countries (JAP 1990). In fact, a number of North American business schools have been offering courses in technology transfer, technology management, and industrial marketing, for the last few years as will be seen later. In the third world, the surface has been barely scratched. It is not surprising,

therefore, that it proved much easier to find educational material in North America, than in the third world.

Segmenting the market for training

When we speak of training in the context of utilization of research results, we must consider how the market for that training should be segmented. Our target audience is composed primarily those that are responsible for managing the research establishments and the utilization process: directors of research institutes, research managers, research planners in the bureaucracy, and heads of agencies that provide intermediary links between the researchers and the end users. Each group might need a slightly different emphasis, which would provide the first level of segmentation, although there is some value to treating them as one audience, and let each group learn from the other.

Another way of segmenting the training market is according to the nature of the research and utilization process itself. As we noted earlier, this process may be very different in the case of research into agricultural products, policy and social science research, or research into manufacturable goods. In each case the technologies, institutional linkages and distribution channels are very different and other than the use of general marketing principles, have very little in common. And yet a major component in any curriculum for training senior managers in developing better utilization strategies should be precisely how to recognize the critical utilization linkages between institutions, agencies, and end-users. This means that we may have to segment our market for training courses in utilization strategies according to the nature of the sector. This was recognized by Dr.Moussa Kola Cissé of CESAG in Sénégal. In his project proposal to follow-up the seven-year old IDRC-funded project AGIR, Cissé proposes course modules that will separately address agricultural research, social science research, public health research, and technology research. (Cissé 1989)

Educating managers and planners: executive training

When we speak of training for utilization, we really mean developing very specialized training modules for selected managers, research directors, and planners, i.e. professional individuals with at least ten or fifteen years of working experience. This form of executive training is used frequently in western companies.

A requirement of this type of training is that it must relate to the very real working experience of the students, and that the concepts must be sufficiently "internalized", so that the manager or executive comes out of the course with measurably improved managing or planning skills. Case courses, using real "live" examples, presented in a class discussion are very often used in this context.

One critical aspect of designing management courses, even for executives, is that the concepts and style must be in tune with the country's social and cultural reality (ILO). In a similar vein, utilization challenges in countries with sophisticated industrial structure like Argentina or Brazil, will be markedly different from those in Western Africa, or South East

Asia with its NIC's, and this also should be reflected in a curriculum. This means that a distinct training program should be designed for each major region, with suitable case studies and real life exercises. This leads us to the implementation issue of finding appropriate regional centres of expertise which could develop and deliver a utilization training program. A centre could be a business school, a large university with a management training program, or a large research centre with training facilities.

Summaries of course outlines

Following is a brief summary of the course outlines presented here. Details are given in the appendices.

Most courses deal with innovation as applied to companies and firms in industrial countries. The universities of Cornell and Florida offer courses in communications and development, which address the marketing side of innovation dissemination. The Philippines Research Management Centre in the Philippines specializes in modular courses for research management, primarily in the agriculture related sectors. Lastly, Tufts, and to some extent Compiegne, offer a mix of management as well as technology and industrial policy. It should be stressed that these outlines are not comprehensive, as there are many more universities and centres that offer courses related to our area of interest. There are areas which are not covered here, namely utilization in specific contexts: agricultural research and extension, public policy research and government use of that research. The sample presented here demonstrates clearly the range of options available and richness of choice of material which could be culled to design a utilization course for a particular third world country.

1. Cornell University

Contact:

Dr. R.D. Colle
CPS 90
Department of Communication
Cornell University
640 Stewart Avenue
Ithaca, NY 14850
Tel: (607) 255-6500
Fax: (607) 255-0788

Cornell offers a summer course in communication planning and strategy. Among the topics covered are: developing a communication strategy, analyzing audiences, message design issues, media selection, mobilization of resources, interpersonal

communication, mass media, small group communication, and communication research and evaluation. (See Appendix B)

2. Florida State University

Contact:

Prof. John K.Mayo
Centre for International Studies
Learning Systems Institute
204 Dodd Hall
Florida State University
Talahasee, Florida
USA 32306-4041
Tel: (904) 644-5442
Fax: (904) 644-3783

See Appendix C

3. Rensselear Polytechnic Institute

Contact:

Prof. Pier Abetti
Management of Technology and Entrepreneurship
School of Management
RPI
Troy, New York 12180-3590
tel: (518)-276-6834

RPI offers in its MBA a program concentration on the Management of Technology, as well as courses in technological entrepreneurship.

Courses taught by Pier Abetti and his colleagues at RPI, and elsewhere (including U. of Calgary, Alberta) include:

Management of Technological Innovation.

This course, which was offered at the University of Calgary, covers the process of technological innovation and technology transfer, methods for managing technological innovation as a strategic resource for a firm, the role of the entrepreneur or intrapreneur, and preparation of business proposals for new products, processes or service.

Seminar in high-tech marketing

This course examines issues in marketing of high-technology products, processes, systems and services; the interface between R&D and marketing; the new product learning cycle; analysis of complex marketing issues for presentation to non-technical senior managers.

Industrial Marketing

This course covers the marketing of products, processes and services to commercial enterprises, government agencies and non-profit institutions. It will also provide an understanding of the background and motivation of purchasing agents and technical sales persons. There are business cases in the course, as well as a final project.

Technological entrepreneurship

This course covers how successful new technological ventures are created, developed and financed. The course is very much hands-on and involves field practice with actual entrepreneurs and companies in the RPI incubator and technology park, under the guidance of experienced entrepreneurs and consultants.
(See Appendix D)

4. Harvard Business School

Contacts:

Profs. Kim Clark,
Dorothy Leonard-Barton, and
Oscar Hauptman
Harvard Business School
Soldiers Field Road
Boston, Mass.,
02163

At the Harvard Business School, technology management is taught in the context of industrial manufacturing, or Production and Operations Management, as it is called. The following courses are taught at the Business School.

Doctoral seminar on Technology and Operations Management:

This covers operations management, operations strategy, technology management, and technology strategy. Technology management includes the innovation process, planning for new technologies, managing research, managing development of new products and processes, and implementing new technologies. Technology strategy deals with the nature of technological change, technology and competition, and the integration of technology and business strategy.

Developing and managing technology (2nd year MBA course)

This course focuses on three themes: the nature of technological change; the development of new products and processes, including the organization and management of specific projects and the integration of marketing, manufacturing and engineering; and the linking of product and process development to business strategy through the development and implementation of a technology strategy.

The course also includes a computer exercise that simulates the development and building of a space station.

Advanced manufacturing and technology policy:

This second year MBA course looks at information-intensive process technologies (eg. microprocessor and computer-based technologies) and their role in global industrial competition. The course examines the underlying structure of these technologies and their implications for management, and is heavily based on actual case studies in industries ranging from fabricated piece parts to continuous processes, and technologies including: computer integrated manufacturing, computer-aided design, artificial intelligence, flexible manufacturing systems, as well as new forms of shop floor integration such as Just-In-Time systems and group technology. (See Appendix E)

5. Technology and Innovation Management Survey

Contact:

Prof. Oscar Hauptman
Harvard Business School
Soldiers Field Road
Boston, Mass.
USA 02163
tel: (617) 495-6345

The Technology and Innovation Management group of the Academy of Management recently sponsored a survey of teaching syllabi in Management of Technology. These were collected by Judy Kamm of Bentley. There were nineteen respondents, and the summary including topics, materials and readings are presented under Appendix F.

6. Tufts University

Contact:

Prof. Denis Simon,
Fletcher School of Law and Diplomacy,
Tufts University
Medford, Mass 02155

(tel:617-628-7010)

Prof. Simon teaches a seminar on international technology transfer which focuses on technology flows, transfer and assimilation in the context of East-West relations, third world development, international competition among the advanced industrial nations, and technology exchanges among developing nations. He also teaches a seminar in comparative technology policy and management, concentrating on the formulation of technological policy at the level of the firm and the nation-state. In addition to national policies to encourage technology generation, commercialization, utilization and adaptation, the course also looks how different industries manage their technology.
(see appendix G)

7. Research Management Centre, University of Los Banos

Contact:

Dr. Rogelio V. Cuyno
Research Management Center
University of the Philippines at Los Banos
College, Laguna
Philippines

Of all the individuals surveyed, Roger Cuyno's material and curricula were the closest to what we are seeking in terms of training research managers in the utilization of research results. The Research Management Centre offers tailor-made courses in research management, including organizational behaviour, finance administration, project management, as well as more technical projects aimed at specific research institutions. Its mission is to "induce the national research system to greater research productivity, more social relevance and greater influence in priming the national development process." RMC's activities include formal and non-formal training, research on research management, publications, technical consultancy, and meetings and conferences.

One course currently being designed by Cuyno is called "Technology assessment and promotion", and addresses specifically the theoretical and practical side of utilization. The course objectives include organizational development, technology assessment and evaluation, and research utilization strategies.

Another course, "Managing success in scientific research" is aimed specifically at individual institutions, to upgrade the research management "know how" and "do how", and to improve working relations between researchers and administrators. A similar course is given under the title "The interdependence of research and support system"

Other material is included under Appendix H.

8. Drexel University

Contact:

Prof. Richard Rosen
Dept. of History/politics
Drexel University
Philadelphia, Pa. 19104
tel: 215-895-2471

Drexel University is primarily an engineering school. In keeping with the discipline of engineering, the courses taught by Rosen and his colleagues aim at teaching students how to design technology for developing countries.

The first of these courses, Design to meet third world needs is taught at the freshman level. Its purpose is to make students aware of the special needs of less developed countries and to encourage preliminary designs that could serve as a basis for further development. The second course, Appropriate Technology and Engineering design is for upper class students who design, and occasionally construct more advanced devices which can frequently be implemented in a less developed nation. A major component of that course is an actual design of a prototype. (See Appendic I)

9. Université de Technologie de Compiègne

Contact:

Prof.Bertrand Bellon
Technologie et Sciences de l'Homme
Université de Technologie de Compiègne
B.P. 649
60206 Compiègne cedex
France
tel: (33) 44-20-99-77

The Technological University of Compiegne (one hour North of Paris) is developing a doctoral program in industrial economics, with major emphasis on technology policy, and is also working on two Masters program streams, one that would be more managerial, the other with more emphasis on policy. The underlying theme of its program is "Maitrise des choix technologiques" or mastery of technological choices. The program includes a mix of economics, management, internationa economics, technology transfer and development, production, human resources, corporate strategy and marketing. No course outlines are available. One course in particular is noteworthy, technology transfer and developing countries.
(See Appendix J)

References

Moussa Kola Cissé "Document de Projet: Mise en place d'un programme de perfectionnement en gestion de la recherche pour le développement en Afrique", Projet AGIR, Décembre 1989.

IDRC (International Development Research Centre). 1987. "Partners in Innovation", Searching, IDRC-257e. p 10-13.

IDRC, Program and Policy Review X, September 1988

ILO (International Labour Office) "Effective Management and Small Enterprise Development", Management Development Programme.

Potworowski, J. André "A Utilization Framework for IDRC Projects", IDRC Division of Communications, July 1989.

Potworowski, J. André "Selected Bibliography and Readings on the Utilization of Research Results in the Third World", IDRC, Division of Communications, January 1990.

McKee, Neill H., "Social Marketing in International Development: A critical Review", MA thesis for the Florida State University, 1988.

Kihlberg, Mats (ed.). 1987. SAREC's First Decade: Swedish Support for Research in Developing Countries - A Progress Report with Some Guidelines for the Future. SAREC (Swedish Agency for Research Cooperation with Developing Countries), Stockholm. 62 p.

# APPENDIX "A"

University of Yaoundé's revised charter
to make it more market-oriented
(excerpt)

REPUBLIQUE DU CAMEROUN

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PAIX - TRAVAIL - PATRIE

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DÉCRET N° 89/1777 / DU 07 DEC. 1989

Portant réorganisation administrative de l'Université de YAOUNDE.-

LE PRESIDENT DE LA REPUBLIQUE,

VU la Constitution ;

VU le décret n° 89/674 du 13 avril 1989 modifiant et complétant certaines dispositions du décret n° 88/772 du 16 mai 1988 portant organisation du Gouvernement ;

VU le décret n° 62/DF/289 du 26 juin 1962 portant création et organisation de l'Université et les textes modificatifs subséquents ;

VU le décret n° 88/1487 du 7 octobre 1988 portant réorganisation des Centres Universitaires et fixant les dispositions communes applicables à toutes les Institutions Universitaires ;

D E C R E T E

TITRE I - DISPOSITIONS GENERALES

Article 1er :

(1) L'Université de YAOUNDE est un Etablissement Public Administratif à caractère scientifique et culturel, doté de la personnalité morale et de l'autonomie financière.

(2) Elle est placée sous la tutelle du Ministre chargé de l'Enseignement Supérieur.

Article 2 :

L'Université de YAOUNDE a pour mission l'enseignement supérieur et la Recherche Scientifique.

.../...

Elle assure en outre la formation et le perfectionnement des cadres scientifiques, techniques, pédagogiques et administratifs dans les Grandes Ecoles et les Centres spécialisés.

Elle concourt à l'appui au développement et à la promotion sociale et culturelle.

Elle assure la coopération inter-universitaire, dans le cadre des accords et conventions.

Article 3 .-

L'Université de Yaoundé a le pouvoir de collation des grades, titres et diplômes.

Article 4 .-

L'Université entretient avec les Centres Universitaires et les organismes de recherche scientifique et technique des rapports particuliers. Ils se traduisent notamment par l'utilisation des enseignants ainsi que par la conduite en commun de programmes de recheche au sein des unités d'enseignement et de recherche (UER) et au sein des équipes de recherche associées (ERA).

Article 5 .-

La République du Cameroun garantit au personnel enseignant de l'Université de Yaoundé, dans le cadre du respect des Lois et Réglements, du devoir de réserve imposé à tous les Agents de l'Etat, l'exercice des franchises et libertés universitaires.

## TITRE II - DE L'AUTORITE DE TUTELLE

Article 6 .-

Le Ministre chargé de l'Enseignement Supérieur assure la tutelle de l'Etat sur l'Université de Yaoundé.

Il harmonise la formation universitaire avec les exigences du développeme économique, social et culturel de la Nation.

Il délivre les diplômes, au vu des certificats de réussite établis conformément aux usages universitaires.

Il comprend deux bureaux :

- le bureau du recrutement et des avancements ;
- le bureau de l'évaluation et du contentieux.

## B - DE LA DIVISION DE LA RECHERCHE ET DES PUBLICATIONS

Article 42 .-

Placée sous l'autorité d'un Chef de division, la division de la recherche et des publications est chargée :

- des études sur les programmes et projets de recherche en relation avec les administrations publiques et privées et des utilisateurs potentiels des résultats de la recherche ;

- de la centralisation des projets de recherche en vue de leur examen par les sous-commissions de la commission scientifique ;

- de l'appui logistique aux publications des enseignants ;

- de la mise en place, du suivi et de l'évaluation des équipes de recherche installées au sein des établissements ;

- de la constitution et de la protection du patrimoine scientifique de l'Université de Yaoundé ;

- de la collaboration avec les organismes de recherche scientifique et technique notamment en matière de programmes de recherche, de leur financement, de la mise en place des équipes de recherche associées (ERA).

Elle comprend deux services :

- le service de la recherche ;
- le service des publications.

Article 43 .-

Placé sous l'autorité d'un Chef de service, éventuellement assisté d'un adjoint, le service de la recherche est chargé de la promotion, de l'évaluation et de la valorisation de la recherche.

A cet effet, il s'occupe :

.../...

- de la prospection en besoins de recherche auprès des utilisateurs potentiels ;

- de l'examen des demandes en matière de recherche introduite par les utilisateurs potentiels ;

- de la mise en forme des projets présentés par les enseignants pour le compte des travaux des sous-commissions et de la commission scientifique.

*Il comprend :*

- le bureau de la promotion de la recherche ;
- le bureau de l'évaluation et de la valorisation de la recherche.

Article 44.-

Placé sous l'autorité d'un Chef de service, éventuellement assisté d'un adjoint, le service des publications est chargé de toutes les questions relatives aux publications.

Il comprend deux bureaux :

- le bureau des interventions ;
- le bureau de la diffusion.

## C - DE LA DIVISION DE LA PLANIFICATION ET DU DEVELOPPEMENT

Article 45.-

Placée sous l'autorité d'un Chef de division, la Division de la planification et du développement est chargée, en rapport avec la commission de la planification et du développement :

- de la planification et des statistiques des effectifs enseigants et étudiants en conformité avec les besoins de formation et de perfectionnement ;

- de l'étude sur l'accès aux établissements de l'Université de Yaoundé et de la prévision des effectifs à court et à long terme ;

- de l'étude sur la capacité d'accueil des établissements, conformément aux normes universitaires internationales ;

- de la réglementation pour une politique d'orientation universitaire

# APPENDIX "B"

Cornell University Course outlines

*PRELIMINARY ANNOUNCEMENT OF A SHORT COURSE IN*

# COMMUNICATION PLANNING AND STRATEGY AT CORNELL UNIVERSITY

## July 11 – August 7, 1990

For officials and project leaders in health, agriculture, nutrition, family planning and related sectors

**The Program**

This will be the 10th year for this workshop/seminar that has attracted more than 300 persons from 55 nations. The program emphasizes organization of communication and non-formal education programs directed at various groups of people–from policy makers to villagers. Among the topics covered are: developing a communication strategy, analyzing audiences, message design issues, media selection, mobilization of resources, interpersonal communication, mass media, small group communication, and communication research and evaluation. Program includes a field trip to Washington, DC to meet with agencies in development communication.

**The Participants**

Participants include project directors, ministry officials, extension specialists, community health leaders, officers from international and bi-lateral development agencies, agricultural research organizations, and nutrition institutes, persons from academic institutions, and others with an interest in communication and rural development.

**Enrollment Information**

Enrollment is limited to 24 persons. Fee is US$2,200.00 for the four week program. This does not include housing, transportation, and personal expenses. Housing in university dormitory accommodations and the Washington hotel is estimated at a total of US$650. Overseas participants should plan to arrive July 9 or 10, 1990.

**Point of Contact**

For further information and a seminar outline, write:

Dr. R. D. Colle
CPS 90
Department of Communication
Cornell University
640 Stewart Avenue
Ithaca, NY 14850

Fax 607-255-0788 Telex 6713054 Telephone 607-255-6500

# Communication Courses at Cornell University
# Summer 1990

The following courses may be taken for credit toward university degrees. The tuition fee is $315 per credit hour. For information on these courses, contact Dr. Ralph Thompson, Department of Communication, Roberts Hall, Ithaca, N.Y. 14853. Telephone: 607-255-4452. Fax: 607-255-7905.

## Three Week Session — May 30 – June 22, 1990

460 **Video Communication I: Basic Concepts and Skills.** 3 Credits. M–F 9–12. S. White. Focus on video as an organizational communication learning tool in the development context, either domestic or third world.

490 **History of Television.** 3 Credits. M–F 9–12. Robert Thompson. A cultural, social and political history of post-war America as seen through television.

## Six Week Session — June 25 – August 7, 1990

116 **Theories of Human Communication.** 3 Credits. M–F 10–11:15. R. Roe. Students will be introduced to the basic areas of study common in communication theory and research.

120 **Introduction to Mass Media.** 3 Credits. M–F 11:30–12:45. J. Tankel. History, processes, philosophies, policies and functions of the major communication media in the United States.

150 **Writing for the Media.** 3 Credits. M–F 1–2:15. J. Brown. Basic writing for newspapers, television, and radio. Emphasizes clarity and style in news and feature writing.

201 **Oral Communication.** 3 Credits. M–F 8:30–9:45, 10–11:15, 11:30–12:45 or 1–2:25. Ralph Thompson, R. Roe, D. Fraleigh, S. Fadden. Theory, preparation, delivery, and evaluation of oral presentations.

204 **Effective Listening.** 3 Credits. M–F 11:30–12:45. S. Warland. An analysis of the process of listening, barriers to effective listening, and techniques for improving listening skills.

205 **Parliamentary Procedure.** 3 Credits. M–F 1–2:15. D. Fraleigh. Techniques for conducting effective meetings, including both formal parliamentary procedure and alternatives.

216 **Communicating Interpersonally.** 3 Credits. M–F 1–2:15. S. Warland. Emphasizes an understanding of interpersonal communication in both the personal and professional arenas.

234 **Photo Communication.** 3 Credits. T R 7–10 p.m. J. Reis. Basic photography: camera handling, photo layout, critical analysis. Emphasis on photojournalism in latter portion of course. No darkroom work.

250 **Newswriting for Newspapers.** 3 Credits. M–F 1–2:15. D. Lindorff. Writing and analyzing news stories. A study of elements that make news, news sources, interviewing, style and structure, press problems, press-society relations. Keyboarding ability essential.

272 **Principles of Public Relations and Advertising.** 3 Credits. M–F 8:30–9:45. C. Whittle. Survey of public relations and advertising organizations, jobs, functions in the industry, roles in society, the economic system, and formal organizations.

301 **Business and Professional Speaking.** 3 Credits. Prerequisite: Comm. 201 or permission of instructor. M W 7–10 p.m. E. Owens. Study and practice of oral communication skills used in organizations, including speeches, interviews, reports, and discussions.

342 **Electronic Media.** 3 Credits. Prerequisites: Comm. 120, 150. T R 1–4. T. Russo. Techniques of audio and video production. Emphasis on scripting and recording audio and video public information projects.

363 **Organizational Writing.** 3 Credits. Prerequisite: any college-level writing course. M–F 1–2:15. L. Van Buskirk. Students write in the positions of supervisor, subordinate, colleague, and representative of business, government, community, and other organizations.

365/665 **Scientific Writing.** 3 Credits. M–F 10–11:15. A. Wilkinson. Writing scientific and technical material for peers. Assignments include instructions, abstracts, literature reviews, descriptions of materials and methods, preparation of tables and figures, research proposals, progress reports, presentation and discussion of data.

410 **Organizational Communication.** 3 Credits. Prerequisite: Comm. 116 or equivalent. T R 7–10 p.m. E. Owens. A study of management communication practices in formal organizations with an emphasis on communication between supervisor and subordinate.

461 **Video Communication II: Training and Development Applications.** 3 Credits. Prerequisite: Comm. 348, 460, or equivalent. June 26 – July 12. T R 1–4. S. White. Advanced concepts of video application training and development. Design of video training modules, video as a research and documentation tool, interactive video.

624 **Communicating for Social Change.** 3 Credits. T R 9–12. J. Servaes and S. White. Current international communication problems in the so-called Third World. The sociocultural, economic, political, and scientific-technical roles of communication in the Third World.

*790 **Participatory Programs in Action Research.** 3 Credits. July 31 – August 21. K. S. Nair and S. White. Concepts of participation as related to conducting field research in development contexts. Explores the value framework, philosophies, theories, and methodologies which apply to development communicators wishing to make their work relevant to the "grass roots" message receiver.

*Note: Communication 790 begins during the 6-week session but extends beyond August 7. For further information about Communication 790, contact Dr. Shirley White (255-6500)

CORNELL
UNIVERSITY

# APPENDIX "C"

Florida State University Course outlines

MMC 6920 Summer 1989

COMMUNICATION AND CHANGE: THE DIFFUSION OF INNOVATIONS

Instructor: John K. Mayo
204 Dodd Hall
Tel.: 644-5442

Schedule: Tuesday and Thursday, 2:00-4:45

Place: 230 Diffenbaugh Building

## Purpose of the Course

MMC 6920 is a seminar designed to provide you with an understanding of the role of communication in social change and the diffusion of innovations. Accordingly, various theoretical and practical issues pertaining to development and to communication's roles in the diffusion of innovations will be examined. At the end of the course, it is expected that you will have a comprehensive and useful framework for understanding the relationship between communication and social change. You will also be able to formulate strategies for developing, testing and evaluating communication campaigns aimed at changing human behavior.

## Course Plan

A central concern of the seminar will be communication strategies; that is, methods for changing attitudes and behaviors through the transfer of new ideas and knowledge. A strategy involves application of communication concepts; it is where theory and research must come together with program needs, practices and constraints. While we will draw upon numerous U.S. examples, the focus of the discusssions and readings will be international and comparative in scope, with particular attention to the problems confronting the developing nations of Asia, Africa, and Latin America.

There will be two meetings of the seminar each week. At these meetings we will consider issues arising from the readings and discuss the challenges change agents face in the field. Part of each meeting will be devoted to presentation of background or case material by the instructor, to simulation exercises, or to the screening of video tapes which bear directly on a particular session's topic. The remainder of each session will be devoted to student-lead discussions and exercises. These discussions and reports are considered an essential ingredient of the course, so it is important that you come to each seminar prepared (e.g. by having read the assigned materials beforehand).

## Readings

The course text is Everett M. Rogers' book, Diffusion of Innovations (New York: Free Press, 1983). It has been ordered through Bill's Bookstore. A number of readings in the second half of the course are drawn from Ronald E. Rice and William J. Paisley's book, Public Communication Campaigns (Beverly Hills, CA: SAGE, 1981). These are on reserve in Strozier Library. In addition, we will make use of other articles found in a reading packet prepared for this course, and available at Kinko's Copy Center.

## Term Project

The seminar will require a substantial amount of independent work in the compressed (6-week) semester.

The term project will allow you to explore in-depth some aspect of the diffusion of innovations. The project may take various forms: 1) the development of a plan for introducing change in an area of particular interest to you (e.g. education, health, business or industry, etc.); 2) a critique of some communication/diffusion strategy already enacted; or 3) a more theoretical exercise dealing with one or more of the course's central themes. The instructor will be glad to discuss potential topics with you before you begin writing. A "concept paper" and outline are due on May 25th, with a final submission date of June 15th.

## Evaluation Criteria

Grades for the course will be determined in the following manner:

| | |
|---|---|
| Term project | 80% |
| Class participation | 20% |

May 9 — Introduction to the Seminar

1. Overview of topics and readings
2. Schedule and requirements
3. Participants' interests and background

The Elements of Diffusion

1. Main components of the classical diffusion model
2. S-M-C-R-E model of communication
3. Major modifications to the S-M-C-R-E approach
4. Nature of communication strategies
5. Balancing interpersonal and mediated communication

Read: Course Outline

May 11 — Diffusion and "Development": a Re-appraisal

1. The dominant paradigm of development
2. Alternative pathways of change
3. Structural vs. psychological determinants of change
4. Biases of diffusion research

Case Study: Florida's Institute of Food and Agricultural Sciences (IFAS)

Read: Rogers, Chap. 1: "Elements of Diffusion"

Chap. 2: "A History of Diffusion Research" (skim)

Chap. 3: "Contributions and Criticisms of Diffusion Research"

May 16 — Where Do Innovations Come From?

1. Recognizing problems and assessing needs
2. Basic and applied communication research
3. Extension services in the U.S. and abroad
4. Innovations as "technology clusters"

Case Study: Seepage Irrigation in Florida

The Innovation-Decision Process

1. Stages/functions in the innovation-decision process
2. Felt needs and incentives
3. Preventive innovations and cues to action
4. Ethics of persuasion

Read: McAnany, "The Diffusion of Innovation: Why Does it Endure" (packet)

Rogers, Chap. 4: "The Generation of Innovations"

Chap. 5: "The Innovation-Decision Process"

May 18 — Perceived Attributes of Innovations

1. The 5 perceived attributes
2. Designing messages for acceptability and impact
3. Explaining rates of adoption

Campaign Planning Exercise

Read: Rogers, Chap. 6: Attributes of Innovations and Their Rate of Adoption"

Solomon, "Frameworks for Message Formation: What to Put in the Message" (packet)

Rogers and Storey, "Communication Campaigns" (packet)

May 23 — Innovations and Adopter Categories

1. Safety and Competence Credibility
2. Information screens
3. Adopter curves
4. Adopter categories
5. Resistance to change

Read: Rogers, Chap. 7: "Innovations and Adopter Categories"

May 25 — Opinion Leadership

1. Personal influence and communication flows
2. Interpersonal diffusion networks
3. Opinion leaders, cliques, liaisons, cosmopolitans and isolates
4. Interlocking and radial communication networks
5. The strength of weak ties

Organizational Communication and Innovations

1. Authoritative vs. collective innovation decisions
2. Characteristics of innovative organizations

Read: Rogers, Chap. 8: "Opinion Leadership and Diffusion Networks"

Rogers, Chap. 10: "Innovation in Organizations

Huberman and Miles, "What Have We Learned" (packet)

**Turn in "concept paper" (250 words) and outline for term project.**

May 30 — Change Agents

1. Characteristics, roles, and strategies
2. Agency vs. client orientation
3. Bridging socioeconomic and cultural gaps

Case Studies

1. Australian missionaries
2. Aymara missionary ("The Healer")

Read: Rogers, Chap. 9: "The Change Agent"

L. Sharp, "Steel Axes for Stone Age Australians" (packet)

Inter-American Foundation, "The Foundation as Learner" (packet)

June 1 — **No Seminar Meeting**

June 6 — Telecommunications in Diffusion and Development

1. Creating a climate for change
2. "Big," "Small," and "intermediate" technologies
3. Selecting media
4. The Re-invention of radio and the telephone

Student Project Presentations

Read: B. Dervin, "Mass Communicating: Changing Conceptions of the Audience" (Rice and Paisley, Chap. 3)

E. McAnany, "Radio's Role in Development: Five Strategies of Use" (packet)

Maitland Commission, The Missing Link (Executive Summary) (packet)

June 8 — Social Marketing: Theory and Practice

1. Historical and theoretical perspectives
2. Recent public communication campaigns

Student Project Presentations

Read: McGuire, "Theoretical Foundations of Campaigns" (Rice and Paisley, Chap. 2)
Fox and Kotler, "The Marketing of Social Causes: The First 10 Years" (packet)
McKee, "The Evolution of Social Marketing in International Development" (packet)

June 13 — Assessing the Effectiveness of Social Marketing Campaigns

1. Cognitive, attitudinal and behavioral change
2. Communication effects gaps
3. The ethics of social marketing

Student Project Presentations

Read: Flay and Cook, "Evaluation of Mass Media Prevention Campaigns" (Rice and Paisley, Chap. 12)

Rasmuson and Booth, "The Role of Formative Evaluation in the Mass Media Health Practices Project" (packet)

McKee, "Towards a Community-Based Marketing Process" (Packet)

**Turn in term projects**

June 15 — Past, Present & Future Directions

1. Understanding social change
2. Communication and change: Where have we been; where are we headed?

Student Project Presentations

Read: Rogers, Chap. 11, "Consequences of Innovations"

Werner, "Public Health, Poverty and Empowerment - A Challenge" (packet)

MMC 5301-01 Fall 1989
COMPARATIVE SYSTEMS OF MASS COMMUNICATION

Instructor: John K. Mayo
204 Dodd Hall
Tel: 644-5442

Place: 124 Diffenbaugh

Schedule: Thursdays, 2:00-4:45 p.m.
plus two tutorial meetings

The seminar is designed to be as flexible and as responsive to individual interests as possible. There will be weekly seminar meetings to consider issues arising from the required readings and to discuss the kinds of problems communication policy-makers and researchers are currently facing in the field--e.g., instituting, administering, and evaluating media systems in different cultural contexts; training educators and other specialists to use media in development campaigns; evaluating the political feasibility of satellite systems for the multinational exchange of educational and commercial programs; etc. Part of each seminar meeting will be devoted to a review of background or case material by the instructor or to the screening of videotapes which bear directly on a particular week's topic. The bulk of the seminar's work, however, will be borne by its members, and the objectives of the course cannot be met without the full participation of all.

Seminar discussions will be based on a set of required and recommended readings in the following areas:

- Contemporary Approaches to the Study of Mass Communication Systems
- Structures and Functions of National Communication Systems
- National and International Communication Policies
- The Manufacture and Transmission of News and Images
- Communication and Development: Theoretical Perspectives
- Communication Strategies for Education and Training
- Communication Strategies for Rural Development and Social Change
- The Impact of New Communication Technologies
- Rural Telecommunications
- Ethical Issues in the Transfer of Communication Technologies
- International Communication in the 1990's

Many of the seminar's readings are found in George Gerbner and Marsha Siefert's book, World Communication: A Handbook (Longman: New York, 1984). The book is available at Bill's Bookstore. All other required readings have been reproduced and will be made available in packet form at Kinko's.

In addition to ths seminar meetings, there will be two tutorials. In the tutorials, seminar members will meet in small groups to present and discuss short essays based on the readings. Topics for the essays will be proposed by the instructor in advance and students will submit their essays in the week prior to their scheduled tutorial meetings. The two essays plus a take-home final exam will constitute the course's written requirements. (In lieu of the the take-home exam, students may choose to concentrate on some aspect of the seminar, submitting a term paper at the end of the semester. Students selecting this alternative should notify the instructor of their intention as soon as possible and submit an outline of their projects no later than October 20th).

Grades for the course will be determined in the following manner:

| Option 1 | | | Option 2 | |
|---|---|---|---|---|
| Tutorial essays (2) | 30% | | Tutorial essays (2) | 30% |
| Take-home exam | 50% | or | Term paper | 50% |
| Class participation | 20% | | Class participation | 20% |

Members of the seminar are encouraged to go as far as they wish beyond the basic requirements of the course. If they are already familiar with some of the required or recommended readings, they may request others. The instructor's role will be to guide, to advise, and to make his own library and files available to members of the seminar. The course is intended to provide the student with an overview of this absorbing and controversial field, emphasizing those aspects which come closest to his or her own interests and aspirations.

# COURSE SYLLABUS

**UNIT 1**: Introduction: Contemporary Approaches to the Study of Mass Communication Systems

Required Reading:

Course Syllabus

**UNIT 2**: Structures and Functions of National Communication Systems

Required Readings:

1. Edward Ploman, "The Changing Information Society" (packet)
2. Denis McQuail, "Normative Theories of Media Structures and Performance" (packet)
3. Hanno Hardt, "The Study of Cultures: Comparative Communication Research" (packet)
4. Samuel Becker, "Marxist Approaches to Media Studies: The British Experience" (packet)

Recommended Readings:

1. Sean McBride et al., Preface, Part I of Chapter 2 ("The Contemporary Dimension"), Part II of Chapter 3 ("Integration: Changing Patterns"), and Part III of Chapter 4 ("Concentration") in Many Voices, One World
2. Gerbner and Siefert, Part 4: "Mass Communications: Development Within National Contexts"
3. John C. Merrill, Global Journalism: A Survey of the World's Mass Media, Part I
4. Elizabeth Fox (ed). Media and Politics in Latin America: The Struggle for Democracy
5. S. T. Kwame Boafo and Raquel Salinas, "Communication Policy-making in Sub-saharan African counties and Latin America" (Budapest: IAMCR, 1988)

**UNIT 3**: National and International Communication Policies

Required Readings:

1. Gerbner and Siefert, Chapters 3, 4, 5, 9, 10, 43,
2. "The NWICO and the Right to Communicate," (packet)
3. "The Declaration of Talloires" (packet)
4. Colleen Roach, "The U.S. Position on the New World Information and Communication Order (packet)
5. Robert White and Jim McDonnell, "Priorities for National Communication Policy in the Third World" (packet)

Recommended Readings

1. Tapio Varis, "Global Traffic in Television," in Journal of Communication, Winter 1974
2. Jeremy Tunstall, The Media Are American (New York: Columbia University Press, 1977)
3. Alan Wells (ed.), Mass Communications: A World View

**UNIT 4**: The Manufacture and Transmission of News and Images

Required Readings

1. Gerbner and Siefert, Chapters 11, 12, 17, 20,
2. Robert L. Stevenson and Richard R. Cole, "Issues in Foreign News" (packet)
3. The "World of the News" Study (packet)
4. Ithiel de Sola Pool, "The Changing Flow of Television" (packet)

Recommended Readings

1. Herbert J. Gans, Deciding What's News (New York: Pantheon, 1979)
2. University Media Group, Bad News (London: Routedge and Kegan Paul, 1976) and More Bad News (1980)
3. Peter Golding and Philip Elliot, Making the News (London: Longman, 1979)
4. Oliver Boyd Barrett, The International News Agencies (Beverly Hills: Sage, 1980)
5. Gaye Tuchman, Making News: A Study in the Construction of Reality (New York: The Free Press, 1978)
6. Anthony Smith, The Geopolitics of Information (London: Faber and Faber, 1980)
7. Rosemary Righter, Whose News? Politics Press and the Third World (London: Burnett Books, 1978)
8. C. Hoskins, R. Mirus, and W Rozeboom, "U.S. Television Programs in the International Market: Unfair Pricing?" in Journal of Communication (Vol. 39, No. 2, Spring 1989)

** FIRST TUTORIAL ESSAY DUE AT CONCLUSION OF UNIT 4 **

**UNIT 5**: Communication and Development: Theoretical Perspectives

Required Readings:

1. Centre for the Study of Communication and Culture, "Communication and Development" in Communication Research Trends (Vol. 9, No. 3, 1988/89) (packet)

2. Wilbur Schramm, "Communication Development and the Development Process," (packet)

3. Daniel Lerner, "Communication and Development," in D. Lerner and L. Nelson, Communication Research: A Half-Century Appraisal (packet)

4. Peter Golding, "Media's Role in National Development: Critique of a Theoretical Orthodoxy" in Journal of Communication (packet)

5. Emile McAnany, "From Modernization to Dependency and Beyond: Theory and Practice in Communication for Social Change" (packet)

6. Jan Servaes, "Communication and Development Paradigms: An Overview" (packet)

Recommended Readings

1. Everett Rogers, "The Passing of the Dominant Paradigm"

2. Luis Ramiro Beltran, "Alien Premises, Objects and Methods in Latin American Communication Research"

3. David Lerner, The Passing of Traditional Society, Chapters 1 and 2

4. Wilbur Schramm, Mass Media and National Development

5. Neville Jayaweera and Sarath Amunujama, Rethinking Development Communication

**UNIT 6** : Communication Strategies for Education and Training

Required Readings

1. John Mayo, "Unmet Challenges: Educational Broadcasting in the Third World" (packet)

2. Walter Perry and Greville Rumble, "A Short Guide to Distance Education" (packet)

3. A.W. Bates, "Media in Distance Education" (packet)

4. Robert Arnove, "Sociopolitical Implications of Educational Television," (packet)

Recommended Readings

1. Emile McAnany and John Mayo, Communication Media in Education for Low-Income Countries: Implications for Planning (Paris: UNESCO, International Institute for Educational Planning, 1980)

2. Stephen Anzalone, "Using Instructional Hardware for Primary Education in Developing Countries: A Review of the Literature," December 1986

3. Wilbur Schramm, Lyle M. Nelson, and Mere T. Betham, Bold Experiment: The Story of Educational Television in American Samoa (Stanford: Stanford University Press, 1981)

4. John K. Mayo, Robert C. Hornik, and Emile McAnany, Educational Reform with Television: The El Salvador Experience (Stanford: Stanford University Press, 1976)

5. Alan Hancock, Communication Planning for Development: An Appraisal Framework (Paris: UNESCO, 1981)

6. Merrelyn Emery, "Another Exciting Learning Revolution?" in Prospects, Volume XV, No. 4, 1985

7. Frances Kemmerer, "Limits on the Use of Educational Technology in Developing Countries: A Reappraisal of the Costs"

8. Greta S. Nettleton, "Uses and Costs of Educational Technology for Distance Education in Developing Countries: A Review of the Recent literature"

**UNIT 7**: Communication Strategies for Rural Development and Social Change

Required Readings

1. Emile McAnany, "Radio's Role in Development: Five Strategies of Use" (packet)

2. Everett Rogers, "Where Are We in Understanding Innovation?" (packet)

3. David Evans, "Technology in Non-Formal Education: A Critical Appraisal," (packet)

4. Martin Byram, "Popular Participation in the Mass Media: An Appraisal of a Participatory Approach to Educational Radio," (packet)

5. Gerbner and Siefert, Chapter 33, 34 and 37

6. Joseph Ascroft et al., "Communication in Support of Development: Lessons from Theory and Practice" (packet)

Recommended Readings:

1. Paulo Freire, "Extension or Communication?" in Education for Critical Consciousness

2. Jeremiah O'Sullivan, "Rural Development Programs Among Marginal Farmers in the Western Highlands of Guatemala," pp. 65-92, 107-115

3. Dean Jamison and Emile McAnany, Radio for Education and Development, pp. 7-96

4. Peter L. Spain et al., Radio for Education and Development: Case Studies, Volumes I and II

5. Hernando Gonzalez, "Some Myths of Communication and Development"

**SECOND COMMUNICATION ESSAY DUE AT CONCLUSION OF UNIT 7**

**UNIT 8:** The Impact of New Communication Technologies

Required Readings:

1. James R. Beniger, "The Control Revolution in the Development of the Information Society" (packet)

2. Gerbner and Siefert, Chapters 22, 25, 27

3. Herbert Schiller, "Paradoxes of the Information Age" (packet)

4. Douglas A. Boyd and Joseph D. Straubhaar, "Development Impact of the Home VCR on Third World Countries" (packet)

Recommended Readings:

1. John Mayo and Charles Green, "Consultation on Collaborative Research into the New Communication Technologies"

2. Christine Ogan, "Media Imperialism and the Videocassette Recorder. The case of Turkey" in Journal of Communication (Vol. 38, No 2, Spring 1988)

3. Nordenstreng and Schiller, Part II of "Direct Satellite Broadcasting: Exemplar of the Challenge to National Sovereignty," pp. 115-165

4. Oswald and Gladys Ganley, To Inform or Control? The New Communication Networks

5. WACC, "Access to Communication Satellites" in Communication Resource (No. 11, June 1988)

**UNIT 9:** Rural Telecommunications: A New Development Frontier?

Required Readings:

1. "Telecommunications and the Third World" in Communication Resource, February 1985 (packet)

2. Heather Hudson, "The Role of Telecommunications in the Development Process: Rural Telecommunications in Developing Countries" (packet)

3. Rohan Samarajiva and Peter Shields, "Telecommunication in the Third World: Value Choices in Resource Allocation" (packet)

Recommended Readings:

1. Robert J. Saunders et al., Telecommunications and Economic Development (Baltimore: The Johns Hopkins University Press, 1981)

2. Heather Hudson, When Telephones Reach the Village (New York: ABLEX, 1985)

3. John Mayo, Gary Heald, Steven Klees, and Martha Cruz de Yanes, "Peru Rural Communication Services Project: Final Evaluation Report," February 1987

4. Karen Tietjen, "Telecommunications and Rural Development: Program Overview"

5. Rohan Samarajiva and Peter Shields, "The Integration Assumption in Telecommunicationa and Development: Continuity with Old Paradigm" (Paper presented at the the 39th Annual Conferance of the International Communication Association, San Fransisco, 1989)

**UNIT 10:** Ethical Issues in the Transfer of Communication Technologies

Required Readings:

1. Denis Goulet, Chapters 1 and 2 of The Uncertain Promise: Value Conflicts in Technology Transfer (packet)

2. Elihu Katz, "Can Authentic Cultures Survive New Media?" in Journal of Communication, Volume 27:2, Spring 1977 (packet)

3. John Mayo, "An Ethical Perspectie on the Transfer and Use of Communication Technology for Development" (packet)

Recommended Reading:

1. J. Hamelink Cees, Cultural Autonomy in Global Communications: Planning National Information Policy (New York: Longman, 1983)

**UNIT 11:** International Communication in the 1990s: Research and Policy Issues

Required Readings:

1. Sean McBride et al., Many Voices, One World, Part V (packet)

2. Ithiel de Sole Pool and Herbert I. Schiller, "Perspectives on Communication Research in Journal of Communication, Summer 1981 (packet)

3. Johan Galtung, "Towards a New International Technological Order" (packet)

Recommended Reading

1. Vincent Mosco, "Toward a Theory of the State and Telecommunications Policy" in Journal of Communication (Vol. 38. No. 1, Winter 1988)

2. International Institute of Communications "Reforming the Global Network: the 1989 ITU Plenipotenfiary Conference"

** TAKE-HOME EXAMS OR TERM PAPERS DUE MONDAY, DECEMBER 11th **

# APPENDIX "D"

Rensselear Polytechnic Institute course outlines

90.4961 FALL

COURSE NO.: 80.6968 - ~~Spring~~ 1989

COURSE TITLE: TECHNOLOGICAL ENTREPRENEURSHIP

INSTRUCTORS: Prof. Pier Abetti, Lally Mgt., Rm 314, Ph: x6834
ADJUNCTS:
Mark L. Ludwig, Transition Management, Ph: 203-698-1261
Donald M. Levin, Levin Public Relations, Ph: 914-682-3501
Mark P. Rice, RPI Incubator, Bldg. J, Ph: x2650
Roger Savoy, Rensselaer Technology Associates,
Ph: x6660 and 274-4346

TEXT: LaRue Hosmer and Roger Guiles,
Creating the Successful Business Plan for New Ventures,
McGraw-Hill, 1985

SUPPLEMENTAL TEXT: Jeffry A. Timmons,
New Venture Creation, Second Edition, Irwin, 1985

1. OBJECTIVE:
   - 1.1 The purpose of this course is to learn, by practical field work, how successful new technological ventures are created, developed and financed.
   - 1.2 Students will work in small teams to assist entrepreneurs and companies of the RPI Incubator and Technology Park (the "sponsors") in the preparation of business, marketing, manufacturing and financial plans.
   - 1.3 Guidance to the teams will be given by experienced entrepreneurs and consultants, adjuncts of the School of Management, sponsored by the Center for Entrepreneurship of New Technological Ventures.
   - 1.4 The output of each team will be a formal report to the sponsoring company, with specific conclusions and recommendations.

2. STRUCTURE:
   - 2.1 Since most of the work will be done in the field, classes will meet only six times during the term, according to the schedule below.
   - 2.2 A data base has been collected of companies that have requested assistance. These companies will be "matched" with the student teams by the end of January.
   - 2.3 Between classes each student team will work with their company under guidance of the instructors, one of whom will be assigned as mentor to the team.
   - 2.4 Once a month, each team will hand in a written progress report and present it to the class.
   - 2.5 The final report will be due during the last class, and formally presented to the sponsoring companies and an outside jury of professors, entrepreneurs and venture capitalists.

-continued-

3. GRADING:
   3.1 Final course grade will be weighted as follows:
   20% Class Participation and Case Discussions
   30% Homework
   50% Final Project
   3.2 Individual grades will be given according to the following criteria; in order of importance:
   (a) creative and original thinking, entrepreneurial drive
   (b) depth of analysis
   (c) logical flow of ideas
   (d) clarity and conciseness of written reports and oral presentations

4. TEXTS:
   The texts are for reference only.
   4.1 The sample business plan (Appendix A of the Creating the Successful Business Plan) is an excellent example of meaningful and clear writing.
   4.2 The Timmons book (New Venture Creation) is excellent background for the theory and practice of entrepreneurship.

5. WORKING WITH SPONSORS:
   5.1 Student teams are expected to meet frequently and informally with their sponsors to obtain information and to report on their progress.
   5.2 The confidentiality of information given by the sponsor should be respected.
   5.3 Since entrepreneurs are very busy people, students should plan effective use of the time spent with their sponsors and mentors.
   5.4 Sponsoring companies will reimburse students for out-of-pocket expenses (long distance phone calls, literature, etc.) but authorization must be requested in advance. In case of problems, please contact Roger Savoy.

6. HOMEWORK:
   6.1 All written homework is due on the dates specified below. Justified delays should be discussed with Prof. Abetti before papers are due. Late papers without justification will be downgraded (i.e., B becomes C).
   6.2 Homework should be typewritten, double-spaced, and not to exceed the length specified.
   6.3 Students are expected to work in teams (2 to 4). Synergy is expected, that is two students in a team should produce more than the sum of two individual contributions.
   6.4 Students should create their own teams, but the instructors may suggest changes according to the needs of the class. Team memberships should be fixed by Feb. 1, 1989 at the latest.

7. ATTENDANCE:
   7.1 Attendance is compulsory and roll call will be made during all classes.
   7.2 Justified absences (for reasons of health or work) should be discussed with Pier Abetti preferably before the fact.

-continued-

8. COUNSELING:
   - 8.1 Students are encouraged to meet often with the instructors and mentors, or call them on the phone during business hours.
   - 8.2 Tuesday afternoon, has been set aside by Pier Abetti and Roger Savoy to meet with students. However, please call ahead for an appointment.
   - 8.3 All administrative matters (such as use of computer facilities, long-distance calls, use of data bases, etc.) should be referred to Roger Savoy.

9. FEEDBACK:
   - 9.1 The procedures listed above are tentative. Your feedback, in class or privately, is most welcome and your suggestions will be given full consideration.
   - 9.2 This is a new course for all of us. It can only succeed if we all work together to improve the subject matter, and participate fully in the discussions.

80.6964 TECHNOLOGICAL ENTREPRENEURSHIP - ~~SPRING~~ FALL 1989

| CLASS/DATE | SUBJECTS | HOMEWORK DUE |
|---|---|---|
| 1<br>~~Jan. 18~~<br>SEPT. 6 | 0.1 Introduction<br>0.2 Course Objectives, Structure and Syllabus<br>0.3 Questionnaire<br>1.1 The New Technological Venture and the Entrepreneur<br>1.2 Critical Factors for Success<br>1.3 Review of Candidate Sponsoring companies | None |
| 2<br>~~Jan. 25~~<br>SEPT. 11 | 2.1 Questionnaire Feedback<br>2.2 Presentations by Candidate Sponsoring Companies<br>2.3 Matching of Companies with Student Teams and Mentors | Resume of each student, including motivation and interest in entrepreneurship |
| 3<br>~~March 1~~<br>OCT. 10 | 3.1 First Progress Report Presentations<br>3.2 Discussion of what has been learned in the field, and how to improve working with the sponsoring companies and mentors<br>3.3 Presentation by guest speaker | First progress report, including:<br>1. Objective and description of the project<br>2. Status<br>3. Work plan<br>4. Milestones according to class meeting dates<br>5. Problems or challenges<br>6. Next steps |
| 4<br>~~March 29~~<br>NOV. 6 | 4.1 Second Progress Report Presentation<br>4.2 Discussion of what has been learned in the field, and how to improve working with the sponsoring companies and mentors | Second progress report |

80.6964 TECHNOLOGICAL ENTREPRENEURSHIP - SPRING 1989

| CLASS/DATE | SUBJECTS | HOMEWORK DUE |
|---|---|---|
| 5<br>~~April 26~~<br>DEC 9 | 5.1 Third Progress Report Presentation<br>5.2 Discussion of what has been learned in the field, and how to improve working with the sponsoring companies and mentors<br>5.3 Presentation by guest speaker | Third progress report |
| ~~(May 2-5)~~<br>(DEC 12-15) | Student teams will prepare a draft of their final presentation charts and review them with Pier Abetti and Roger Savoy | |
| 6<br>~~May 10~~<br>DEC. 18 | 6.1 Final presentations to sponsoring companies and outside jury | Final report |

UNIVERSITY OF CALGARY

SYLLABUS Summer 1986 AND 1987

COURSE NO.: MOHR 799

COURSE TITLE: Management of Technological Innovation

INSTRUCTOR: Pier A. Abetti, Ph.D.

TEXTS: (1) Michael J. Martin, Managing Technological Innovation and Entrepreneurship, Reston, 1984.
(2) Michael C. Tushman, William L. Moore, Readings in the Management of Innovation, Pitman, 1982.
(3) Harvard Business School Cases listed below.
(4) Selected articles (H=handouts)

OBJECTIVES: (1) Provide understanding of the process, risks and rewards of technological innovation and of technology transfer.

(2) Provide understanding of the issues of, and methods for, managing technological innovation as a strategic resource of the firm, in order to create wealth and improve the the quality of life.

(3) Present an overview of the role of the entrepreneur or intrapreneur for achieving successful technological innovation.

(4) Provide the theoretical and practical knowledge for the preparation of specific business proposals for the development of innovative new products, processes or services, for existing and new markets.

TO: "Management of Technological Innovation" Students

FROM: Pier A. Abetti, Ph.D.

DATE: July 3, 1986

RE: Homework and grading procedures

I would like to suggest the following procedures for a smooth running course:

1. Reading Assignments

   1.1 Since this is a new course, the syllabus is tentative and may be changed depending on the progress and interest of the class.
   1.2 The list of reading assignments in the syllabus is primarily for reference
   1.3 Specific reading assignments (from the texts or handouts) will be given during each class, for the next class, and may or may not coincide with the syllabus.

2. Homework

   2.1 All written homework is normally due one week after assignment. Justified delays should be discussed with the instructor before papers are due.
   2.2 Homework should be typewritten, double-spaced, and not to exceed the length specified.
   2.3 Students are encouraged to work in teams (2 or 4, exceptionally 5). Synergy is expected, that is two students in a team should produce more than the sum of two individual contributions.
   2.4 Students should create their own teams, but the instructor may suggest changes according to the needs of the class. Team memberships should be fixed by July 15, 1986 at the latest.

3. Attendance

   3.1 Attendance is compulsory and roll call will be made during all classes.
   3.2 Justified absences (for reasons of health or work) should be discussed with the instructor preferably before the fact.

4. Grading

4.1 Final course grade will be weighted as follows:

33% Class Participation and Case Discussions
33% Homework
34% Final Project

4.2 Individual grades will be given according to the following criteria; in order of importance:
(a) creative and original thinking in problem synthesis, entrepreneurial drive
(b) depth of analysis
(c) logical flow of ideas
(d) clarity and conciseness of written and oral presentations

5. Counseling

5.1 Students are encouraged to meet with the instructor, or call him on the phone during business hours.
5.2 I am normally in the office Monday through Thursday, 8:30 a.m. to 5 p.m. (except for classes). Wednesday afternoon has been set aside to meet with students. However, please always call ahead for an appointment.

6. Feedback

6.1 The procedures listed above are tentative. Your feedback, in class or privately, is most welcome and your suggestions will be given full consideration.
6.2 This is a new course for all of us, one of the first in Canada. It can only succeed if we all work together to improve the subject matter, and participate fully in the discussions.

# MANAGEMENT OF TECHNOLOGICAL INNOVATION

Pier A. Abetti — Summer 1986

| CLASS/ DATE | | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|---|
| 1<br>July 3 | 0.1 | Course Objectives, Structure, Syllabus | o Abetti, The RPI Model<br>o Hayes & Abernathy, p.11 | None | None |
| | 0.2 | The Case Method | | | |
| | 0.3 | Questionnaire | | | |
| | 1.1 | <u>The Role of Technological Innovation in Industry</u> | | | |
| | 1.2 | The RPI Incubator Program and Technology Park | | | |
| 2<br>July 8 | 2. | <u>The Process of Technological Innovation and Technology Transfer</u> | o Martin, Chps. 1,2,3,9<br>o Marquis, p. 42<br>o Abetti: Technology-A Challenge to Planners and Milestones (H) | Prepare presentations of innovations | Describe two innovations:<br>1) a successful technological innovation<br>2) an unsuccessful technological innovation<br>How and why did these succeed or fail? What was the time and cost expended? |
| | 2.1 | Conceptual Models | | | |
| | 2.2 | Case History: Power Kinetics | | | |
| | 2.3 | Key factors contributing to success or failure | | | |
| 3<br>July 10 | 3. | <u>Technology Forecasting</u> | o Martin, Chp. 5<br>o Wheelwright & & Makridakis, p. 311 | 1) Prepare Delphi forecast<br>2) Prepare Biodel case | None |
| | 3.1 | Delphi forecast exercise (electric car) | | | |
| | 3.2 | Diffusion and substitution | | | |
| | 3.3 | Case: Diesel vs. steam locomotives | | | |
| | 3.4 | Role and contents of the business plan | | | |
| | 3.5 | Biodel case | | | |
| 4<br>July 15 | 4. | <u>Final Project Proposals</u> | o Hosmer, Example of Business Plan (H) | Prepare Part I presentation | <u>Part I of Business Plan</u><br>1.1 Product description<br>1.2 Customer benefits<br>1.3 Business strategy, objectives<br>1.4 Expected results |
| | 4.1 | Evaluation criteria | | | |
| | 4.2 | Presentations | | | |
| | 4.3 | Evaluation | | | |

MANAGEMENT OF TECHNOLOGICAL INNOVATION cont'd.

Pier A. Abetti

Summer 1986

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 5<br>July 17 | 5. <u>Technology Planning</u><br>5.1 Review of Strategic Planning<br>5.2 Technological strategies<br>5.3 Core technologies<br>5.4 Example: Fork lift trucks<br>5.5 Grumman Case | o Martin, Chps. 7, 10 and 11<br>o Marquis & Patch p. 273<br>o Cooper & Schendel, p. 325 | Prepare Grumman Case | None |
| 6<br>July 22 | 6. <u>Market and Sales Forecasting</u><br>6.1 Engineering systems analysis<br>6.2 Market research & projections: segments, price, volume, & revenue<br>6.3 Part II reviews | o Wind, Grashof & Goldhar, p. 394<br>o Oren, Rothkopf & Smallwood Evaluating a New Market: A Fore-casting System for Non-Impact Computer Printers (H) | Prepare Part II presentations | <u>Part II of Business Plan</u><br>2.1 Market size and growth rate<br>2.2 Market segmentation<br>2.3 Industry and competitive analysis<br>2.4 Marketing plan and projected sales |
| 7<br>July 24 | 7. <u>Transfer of Technology</u>- Part I<br>7.1 Methods of transfer<br>7.2 International transfers<br>7.3 Patents and licensing<br>7.4 Canadian Pratt & Whitney case<br>7.5 Bendix Electronic Fuel Injection case | o Martin, Chps. 11 & 13<br>o Quinn & Mueller, p. 60<br>o Moore & Tushman, p. 131 | o Prepare Pratt & Whitney case<br>o Prepare Bendix Case | None |
| 8<br>July 29 | 8. <u>Transfer of Technology</u>- Part II<br>8.1 Project & Matrix Management<br>8.2 Evaluation of Alternate Suppliers<br>8.3 GE/TELENORM case<br>8.4 Part III reviews | o Martin, Chp. 12<br>o Sayles & Chandler, p. 489<br>o Lawrence, Kolodny, Davis, p. 504 | Prepare Part III presentations | <u>Part III of Business Plan</u><br>3.1 Engineering plan<br>3.2 Manufacturing plan<br>3.3 Distribution plan<br>3.4 A&SP Plan<br>3.5 Milestones |

MANAGEMENT OF TECHNOLOGICAL INNOVATION cont'd.

Pier A. Abetti — Summer 1986

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 9<br>July 31 | 9. <u>New Product Developmnet</u><br>9.1 Newness measures<br>9.2 Success Ratios<br>9.3 Risks<br>9.4 The role of the entrepreneur<br>9.5 GE Intermagnetics General case<br>9.6 Keltron (A) case | o Abetti & Stuart, New Product Development (H)<br>o Cooper, Why New Products Fail (H) | Prepare Role Playing for Keltron (A) case | None |
| 10<br>Aug. 5 | 10. <u>Organizing for Innovation and New Product Development</u>-Part I<br>10.1 Organizational alternatives<br>10.2 The liaison function<br>10.3 Case History: GE<br>10.4 Case History: Bell System | o Martin, Chps. 14 and 15 | Prepare Part IV presentations | <u>Part IV of Business Plan</u><br>4.1 Personnel plan<br>4.2 Organization plan<br>4.3 Resource plan<br>4.4 Simplified P&L & Cash Flow<br>4.5 Risk analysis and abort points<br>4.6 Proposed financing |
| 11<br>Aug. 7 | 11. <u>Organizing for Innovation & New Product Development</u>-Part II<br>11.1 Intrapreneurship<br>11.2 Case History: 3M<br>11.3 Case History: EXXON<br>11.4 Technotronics case | o Martin, Chps. 16 & 17<br>o Lehr, The Role of Top Management (H)<br>o Von Hippel, Successful Internal Ventures (H)<br>o Sykes-Lessons (H) | Prepare Technotronics case | None |

MANAGEMENT OF TECHNOLOGICAL INNOVATION cont'd.

Pier A. Abetti — Summer 1986

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 12<br>Aug. 12 | 12. <u>Analysis of Innovations in Large Companies</u><br>12.1 Small vs. large companies<br>12.2 Non-Impact Printer case<br>12.3 Project EHV Case<br>12.4 The Opportunity Matrix | o Abetti & Stuart, Entrepreneurship,<br>o Oren et al (read again) (H)<br>o Stevenson & Gumpert, Heart of Entrepreneurship (H) | Prepare Non-Impact Printer and EHV cases | None |
| 13<br>Aug. 14 | 13.1 <u>Presentation of Final Projects</u> to a jury of local alumni, R&D managers, entrepreneurs, etc.<br>13.2 Feedback by Jury<br>13.3 Course Summary<br>13.4 Class Evaluation of Course and Instructor | None | Prepare final presentation | Final Project-Complete Report & Presentation Charts |

COURSE NO.: 80.651 - Fall 1988

COURSE TITLE: SEMINAR IN HIGH-TECH MARKETING

INSTRUCTOR: Pier Abetti, Management, Rm 314, Ph: 276-6834

TEXTS:

(1) W.L. Shanklin, John K. Ryans, Jr. Essentials of Marketing High-Technology, Lexington, 1987
(2) Cases listed below
(3) Selected articles (handouts)

OBJECTIVES:

(1) Provide understanding of the specific issues involved in marketing high-technology products, processes, systems, and services
(2) Examine the interfaces between marketing and R&D, manufacturing and strategic planning for new high-tech products
(3) Understand the new product learning cycle and its effect on company strategy and organization
(4) Learn how to analyze and synthesize complex marketing issues (such as the market forecast for a non-existing new high-tech product) for presentation to non-technical business managers and corporate officers

METHOD OF INSTRUCTION:

A typical class will include

(1) Brief presentation of the subject to be discussed, by the instructor or by a guest speaker
(2) Case discussion
(3) Discussion of a relevant topic, chaired by a student

and/or

(4) Informal presentations of progress reports on team projects

TEAM PROJECTS:

Students will work in teams (2 or 3 people) on a high-tech marketing project of their choice, after approval by the instructor.

Pier A. Abetti

# 80.651 SEMINAR IN HIGH-TECH MARKETING

Fall 1988

| SESSION/ DATE | | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|---|
| 1<br>Sept. 12 | 0.1<br>0.2<br><br>0.3<br>1.1<br><br>1.2 | Introduction & Questionnaire<br>Course Objectives, Structure, & Syllabus<br>The Case Method<br>Discussion: <u>What is High-Tech Marketing?</u><br>Subjects for student projects and class discussion | None | None | None |
| 2<br>Sept. 19 | 2.1<br>2.2<br>2.3<br><br>2.4<br><br>2.5 | <u>High-Tech Software and Services</u><br>Case: Software Architects<br>Discussion: Differences between services and product marketing<br>Guest Speaker: Shean O'Sullivan President, MapInfo<br>Selection of student leaders for class discussions | Shanklin, Chps. 1 & 3 | (1) Prepare two examples of successful and unsuccessful cases of marketing high-tech tech services<br>(2) Prepare Software Architects case | None |
| 3<br>Sept. 26 | 3.1<br><br>3.2<br>3.3 | <u>Technological Innovation and Marketing</u><br>Case: Electrodec forecast<br>Discussion: Supply side vs. demand marketing | Shanklin, Ch. 2 | Prepare presentation of Electrodec market and sales forecast | (1) Forecast the market for and sales of Electrodec products 1983-1987, assuming equity investment<br>(2) Justify your forecast<br>(3) What additional research do you propose to validate the forecast? |
| 4<br>Oct. 3 | 4.1<br><br>4.2<br>4.3 | Guest Speaker: Jim MacLachlan, Prof. of Marketing, RPI<br>Case: Lawford Electric<br>Discussion: Selling high-tech products to consumers and industrial customers | None | Prepare Lawford Electric case | None |
| 5<br>Oct. 11<br>(Tuesday) | 5.1<br><br>5.2<br><br>5.3 | <u>High-Tech Marketing Organization and Sales Mgmt</u>.<br>Review proposals for team projects<br>Case: Reach Robotics Corp. | None | (1) Prepare Reach Robotics Corp. case<br>(2) Prepare proposal presentations | Proposal for team projects |

80.651 SEMINAR IN HIGH-TECH MARKETING

Pier A. Abetti

Fall 1988

| SESSION/ DATE | | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|---|
| 6 Oct. 17 | 6.1 | Interfacing Marketing & R&D | Shanklin, Ch. 4 | Prepare Cray Research and Control Data cases. | None |
| | 6.2 | Cases: Cray Research & Control Data | | | |
| | 6.3 | Discussion: Improving R&D/ Marketing Synergy | | | |
| | 6.4 | Guest Speaker: Ken Bubeck, President, Automated Dynamics | | | |
| 7 Oct. 24 | 7.1 | Interfacing Marketing & Mfg. | Riggs: Communication between Engineering and Production (H) | Prepare Apple Computer (I) case Prepare first progress report presentations | Project- first progress report |
| | 7.2 | Case: Apple Computer I | | | |
| | 7.3 | Discussion: Improving Mfg./Marketing Synergy | | | |
| 8 Oct. 31 | 8.1 | Positioning and Selection of Target Markets for High-Tech | Shanklin, Chps. 5 & 9 Abetti- The Case of the Missing Entrepreneurs Oren, et al.: Xerox case | Prepare Non-Impact Printer case | None |
| | 8.2 | Case: Non-Impact Printers | | | |
| | 8.3 | Discussion: Estimating market demand for non-existent products | | | |
| 9 Nov. 7 | 9.1 | Searching for New High-Tech Product Opportunities and Market Research | Shanklin, Ch. 6 Abetti: The Entrepreneur as technology transfer agent | Prepare Project EHV case Prepare second progress report presentations | Project- second progress report |
| | 9.2 | Case: Project EHV | | | |
| | 9.3 | Discussion: Pricing high-tech products- penetration vs. skimming strategies | | | |
| 10 Nov. 14 | 10.1 | Risks in New High-Tech Product Development and Marketing | Abetti: Risk and Innovation in New Product Development | Prepare Intermagnetics General case | None |
| | 10.2 | Case: Intermagnetics General | | | |
| | 10.3 | Discussion: Strategies for controlling risks in marketing new high-tech products | | | |
| | 10.4 | Guest speaker: Mark Rice, Director- RPI Incubator Program | | | |

80.651 SEMINAR IN HIGH-TECH MARKETING

Pier A. Abetti

Fall 1988

| SESSION/ DATE | | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|---|
| 11 Nov. 21 | 11.1 | Managing High-Tech Products | Shanklin, Ch. 7 | Prepare Apple Computer (II) case | Project- third progress report |
| | 11.2 | The New Product Learning Cycle | Maidique: The New Product Development Learning Cycle | Prepare third progress report presentations | |
| | 11.3 | Case: Apple Computer (II) | | | |
| | 11.4 | Discussion: How to improve the success ratio of new products | | | |
| 12 Nov. 28 | 12.1 | High-Tech Marketing Presentations | Shanklin, Ch. 8 | Prepare Honeywell case | None |
| | 12.2 | High-Tech Advertising | | | |
| | 12.3 | Case: Honeywell | | | |
| | 12.4 | Guest Speaker: Bob Vogel, Pres. Advance Technology Services | | | |
| | 12.5 | Discussion: Differences in A&SP of High-Tech vs. Low-Tech products | | | |
| 13 Dec. 5 | 13.1 | Strategic High-Tech Market Planning | Shanklin, Ch. 10 | Prepare draft of final presentation charts<br>Prepare MCI (A) & (B) cases | Draft of final project presentation charts |
| | 13.2 | Case: MCI (A) and (B) | | | |
| | 13.3 | Discussion: Linking technical and marketing strategies | | | |
| 14 Dec. 12 | 14.1 | Presentations of final project reports to a jury of alumni, business people and high-tech entrepreneurs | None | Prepare final project presentations (15 minutes each) | Complete final project report |

TO: "Management of Technology" Students

FROM: Pier A. Abetti, Room 314, Lally Mgmt. Center, Tel: 276-6834

DATE: September, 1988

RE: Homework and grading procedures

I would like to suggest the following procedures for a smooth running course:

1. Reading Assignments

   1.1 Since this is a new course, the syllabus is tentative and may be changed depending on the progress and interest of the class.
   1.2 The list of reading assignments in the syllabus is primarily for reference
   1.3 Specific reading assignments (from the texts or handouts) will be given during each class, for the next class, and may or may not coincide with the syllabus.

2. Homework

   2.1 All written homework is normally due two weeks after assignment. Justified delays should be discussed with the instructor before papers are due.
   2.2 Homework should be typewritten, double-spaced, and not to exceed the length specified.
   2.3 Students are encouraged to work in teams (2 to 4). Synergy is expected, that is two students in a team should produce more than the sum of two individual contributions.

3. Attendance

   3.1 Attendance is compulsory and roll call will be made during all classes.
   3.2 Justified absences (for reasons of health or work) should be discussed with the instructor preferably before the fact.

4. Grading

4.1 Final course grade will be weighted as follows:

33% Class Participation and Case Discussions
33% Homework
34% Final Project

4.2 Individual grades will be given according to the following criteria; in order of importance:
(a) creative and original thinking
(b) depth of analysis
(c) logical flow of ideas
(d) clarity and conciseness of written and oral presentations

5. Counseling

5.1 Students are encouraged to meet with the instructor, or call him on the phone during business hours.
5.2 I am normally in the office Monday through Friday, 8:30 a.m. to 5 p.m. (except for classes). Wednesday afternoon has been set aside to meet with students. However, please always call ahead for an appointment (276-6834).

6. Feedback

6.1 The procedures listed above are tentative. Your feedback, in class or privately, is most welcome and your suggestions will be given full consideration.
6.2 This is a new course for all of us. It can only succeed if we all work together to improve the subject matter, and participate fully in the discussions.

80.651 High-Tech Marketing Seminar

Discussion Leader Preference Sheet

NAME: _____

I would prefer to lead class discussions in the following subjects:

(1 = first choice, 2 = 2nd choice, 3 = third choice)

| Date | Subject | My Preference |
|---|---|---|
| Sept. 26 | Supply-side versus Demand Marketing | _____ |
| Oct. 3 | Selling High-Tech Products to Consumers and Industrial Customers | _____ |
| Oct. 17 | Improving R&D/Marketing Synergy | _____ |
| Oct. 24 | Improving Manufacturing/Marketing Synergy | _____ |
| Oct. 31 | Estimating Market Demand for Non-Existent Products | _____ |
| Nov. 7 | Pricing Strategies for High-Tech Products | _____ |
| Nov. 14 | Risk Control in Marketing High-Tech Products | _____ |
| Nov. 21 | Improving the Success Ratio of New Products | _____ |
| Nov. 28 | Differences in A&SP of High-Tech vs. Low-Tech Products | _____ |
| Dec. 5 | Linking Technical and Marketing Strategies | _____ |

NOTE: The above subjects are indicative. The scope of the discussion may be changed by the discussion leader, within the general framework.

I suggest the following topics for discussion:

A. _____

_____

B. _____

_____

SPRING 1989

80.653 INDUSTRIAL MARKETING

Instructor: Pier Abetti

Guest Lecturer: Mark Ludwig

Schedule: Tuesday, 6:00 - 8:50 p.m.

1. Course Objectives
   (1) Understand the principles of industrial marketing, that is, the marketing and sales of products (hardware, software, documents), processes and services to commercial enterprises, government agencies and nonprofit institutions for resale to other industrial customers or for use in the goods and services that they, in turn, produce,
   (2) Obtain hands-on experience, through the study of business cases and the final project, in analyzing complex marketing situations and making decisions concerning product planning, pricing, distribution, advertising, sales promotion, selling, sales force management, technical documentation, technical and product service. Emphasis will be given to high-technology industries, products, services, systems,
   (3) Understand the background and motivation of purchasing agents and of technical salespersons.

We hope that the exposure to business situations and the preparation of marketing plans will give you the equivalent of years of marketing experience.

2. Texts for the Course
   (1) Robert W. Haas, Industrial Marketing Management, 3rd ed., Kent, 1986
   (2) E.R. Corey, Industrial Marketing Cases and Concepts, 3rd ed, Prentice-Hall, 1983
   (3) Additional cases and articles (handouts)

3. Method of Instruction
   The course will consist of lectures, case discussions, and presentations by student teams on selected topics and problems.

4. Cases
   As a rule, we will discuss one or two cases each week, mostly from Corey's book plus some produced by the instructors. Following the Harvard tradition, a student will be chosen and asked to begin the case discussion by summarizing the key issues (not the facts, which are assumed to be known) and explaining what, in his/her opinion, management should do and why. Nearly all the cases are rich in information and numbers. Often by analyzing the numbers it is possible to identify the most promising approach for management to take. In particular, you should determine break-even volume (in units and market share) whenever possible.

NOTE: These cases require in-depth preparation and analysis. Every student is expected to contribute during the discussion.

5. Final Project

The final project will be carried out by teams of two to four students. Students are encouraged to set up their own teams, but changes may be made to balance skills and backgrounds of the team members. The project consists in the preparation of a MARKETING PLAN for launching a new industrial product, process, or service. It is assumed that sufficient R&D, Engineering and Manufacturing Planning work has been done so that the product is technically viable and may be produced in existing facilities. The purpose of the marketing plan is to determine the size of the targeted market segments, the product, pricing, marketing and distribution strategies, the plans for A&SP, technical documentation, sales training, customer training, etc. and the total marketing costs involved and the expected sales and profits.

Student teams may select either original products according to their own ideas, or one being developed by local entrepreneurial companies, the "sponsors" products. In the latter case, assistance will be given to ensure effective coupling with the sponsors.

In lieu of final examination, the marketing plans will be formally presented by the student teams to the class, the instructors and a jury of local managers and RPI graduates. The final project work will be done during the term, with assignments due as indicated in the attachment. Assignments will be corrected by the instructor and returned one week later. The final report will consist of all the assignments, corrected as needed, plus an executive summary.

NOTE: Due to the tight schedule and the logical sequence of assignments, it is imperative that all assignments be completed on the due date. Unjustified late papers will be downgraded (A to B, B to C, etc.).

COURSE 80.653 - INDUSTRIAL MARKETING

TO: Industrial Marketing Students

FROM: Pier A. Abetti, Mgmt. 314, Tel: 276-6834

DATE: Jan. 16, 1989

RE: Homework and grading procedures

I would like to suggest the following procedures for a smooth running course:

1. Reading Assignments

   1.1 Since this is an evolving course, the syllabus is tentative and may be changed depending on the progress and interest of the class.
   1.2 The list of reading assignments in the syllabus is primarily for reference
   1.3 Specific reading assignments (from the texts or handouts) will be given during each class, for the next class, and may or may not coincide with the syllabus.

2. Homework

   2.1 All written homework is normally due two weeks after assignment. Justified delays should be discussed with the instructor before papers are due.
   2.2 Homework should be typewritten, double-spaced, and not to exceed the length specified.
   2.3 Students are expected to work in teams (2 to 4). Synergy is expected, that is two students in a team should produce more than the sum of two individual contributions.

3. Attendance

   3.1 Attendance is compulsory and roll call will be made during all classes.
   3.2 Justified absences (for reasons of health or work) should be discussed with the instructor preferably before the fact.

4. Grading

4.1 Final course grade will be weighted as follows:

40% Class Participation and Case Discussions
30% Homework
30% Final Project (in lieu of final exam)

4.2 Individual grades will be given according to the following criteria; in order of importance:
(a) creative and original thinking, understanding of key issues, entrepreneurial initiative
(b) depth of analysis
(c) logical flow of ideas
(d) clarity and conciseness of written and oral presentations

5. Counseling

5.1 Students are encouraged to meet with the instructors, or call them on the phone during business hours.
5.2 Tuesday afternoon is the preferred time for meeting with the instructors. Please always call ahead for an appointment.

NOTE: Mark Ludwig will be available on campus only on the dates marked by an asterisk (*). His campus phone is 276-2650. His business phone is (203) 698-1261.

6. Feedback

6.1 The procedures listed above are tentative. Your feedback, in class or privately, is most welcome and your suggestions will be given full consideration.
6.2 This is a new course for all of us. It can only succeed if we all work together to improve the subject matter, and participate fully in the discussions.

80.653 INDUSTRIAL MARKETING

Pier A. Abetti

Spring 1989

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 1<br>Jan. 17 | 0.1 Course Objectives, Structure and Syllabus<br>0.2 The Case Method<br>0.3 Questionnaire<br>1.1 Nature and Scope of Industrial Marketing<br>1.2 Strategy and Customer Classification Schemes<br>1.3 Differences between consumer & industrial marketing | None | None | None |
| 2<br>Jan. 24* | 2.1 Marketing industrial products and services<br>2.2 Case: Loctite Corporation<br>2.3 Case: Gervasi Brothers | Corey, Ch. 1<br>Haas, Chs. 1 & 2 | Prepare two cases: Loctite Corporation & Gervasi Brothers | None |
| 3<br>Jan. 31 | 3.1 Purchasing Management<br>3.2 Buyer Behavior<br>3.3 Procurement Strategies<br>3.4 Case History: GE Power Transformer Strategy<br>3.5 Cases: IBM (I) & IBM (II) | Corey, Ch. 2, pp. 47-74,<br>Haas, Ch. 4 | Prepare IBM (I) and IBM (II) cases | Write case histories of two products, one successful and one unsuccessful in the marketplace. What were the key factors which influenced success or failure? (six pages total) |
| 4<br>Feb. 7 | 4.1 Buyer-Seller Relationships<br>4.2 Negotiations<br>4.3 Final project proposals presentations and class evaluation | Corey, Ch. 2, pp. 75-79 | Prepare final project proposal presentations | Prepare final project proposals according to specified format |

* Mark Ludwig will participate as guest lecturer and will be available for meeting with students.

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 5<br>Feb. 14 | 5.1 Industrial Market Segmentation<br>5.2 Market Selection<br>5.3 Case: Sanders Tax Company<br>5.4 Review of F.P. Sections 1 & 2 | Corey, Ch. 3<br>Haas, Ch. 3 | Prepare role playing for Sanders Tax Co. case, using Product Literature. | Final Project Sections 1 and 2 |
| 6<br>Feb. 21 | 6.1 Product Strategies<br>6.2 New Product Development<br>6.3 Case: Hartford Locomotive<br>6.4 Case: Avon Corporation | Haas, Ch. 7 | Prepare Hartford Locomotive and Avon Corp. cases | None |
| 7<br>Feb. 28* | 7.1 Developing Markets for New Industrial Products<br>7.2 Diffusion of Innovations<br>7.3 Case: Computron<br>7.4 Review of F.P. Section 3 | Corey, Ch. 4<br>Haas, Ch. 6 | Prepare Computron case | Final Project Section 3 |
| 8<br>Mar. 7 | 8.1 Industrial Distribution Strategy<br>8.2 Case: Newport Instrument Div.<br>8.3 Case: Metco Corp. | Corey, Ch. 5, pp. 427-41,<br>Haas, Ch. 8 | Prepare Newport Instrument and Metco Corp. cases | None |
| 9<br>Mar. 14 | 9.1 Pricing Strategy<br>9.2 Pricing for Services, Royalties, Consulting, etc.<br>9.3 Case History: Power Transformer Pricing<br>9.4 Case History: GE Telephone Systems Service Pricing<br>9.5 Case: Woodward Motors<br>9.6 Review of F.P. Section 4 | Haas, Ch. 11 | Prepare Woodward Motor Case | Final Project Section 4 |

* Mark Ludwig will participate as guest lecturer and will be available for meeting with students.

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 10<br>Mar. 28* | 10.1 Distribution of Services<br>10.2 Joint Ventures<br>10.3 Case: IBM (IV) | Read IBM (III) case note | Prepare Role playing for IBM (IV) case | None |
| 11<br>Apr. 4 | 11.1 Managing the Industrial Sales Force<br>11.2 Personal Selling<br>11.3 Sales Effort Allocation<br>11.4 Case History: GE International Apparatus Service<br>11.5 Case History: GE Gas Turbines<br>11.6 Review of F.P. Section 5 | Corey, Ch. 5, pp. 441-58,<br>Haas, Ch. 9 | None | Final Project Section 5 |
| 12<br>Apr. 11 | 12.1 Strategic Planning<br>12.2 Industrial Market Planning<br>12.3 Case: IBM (V)<br>12.4 Case: Ontario Engineering | Corey, Ch. 1, (repeat)<br>Haas, Ch. 5 | Prepare IBM (V) case,<br>Prepare Ontario Engineering Case | None |
| 13<br>Apr. 18 | 13.1 Industrial Marketing Communications<br>13.2 Case: AT&T Long Lines (I)<br>13.3 Review F.P. Section 6 | Haas, Ch. 10 | Prepare AT&T Long Lines (I) case | Final Project Section 6 |
| 14<br>Apr. 25* | 14.1 Industrial Marketing Performance<br>14.2 Controlling & Evaluating<br>14.3 IBM (VI) case<br>14.4 Computron case | Haas, Ch. 12 | Prepare IBM (VI) case | |

* Mark Ludwig will participate as guest lecturer and will be available for meeting with students.

| CLASS/ DATE | SUBJECTS | READING ASSIGNMENTS | ORAL HOMEWORK | WRITTEN HOMEWORK |
|---|---|---|---|---|
| 15 May 2 | 15.1 Rehearsal of final presentations<br>15.2 "Red Shirt Teams" role playing by students, to assess management reaction<br>15.3 Review of course and key issues of industrial marketing | None | Prepare rehearsal of final presentations | Draft of Presentation Charts |
| 16 May 9 | 16.1 Final Project Presentations and Evaluations<br>15.2 Student evaluation of course and feedback to Instructor | None | Prepare Final Project Presentations | Complete Final Report |

80.653 INDUSTRIAL MARKETING
SPRING 1989

FINAL PROJECT PLAN AND SCHEDULE

| (Week) Date | Sections of Marketing Plan |
|---|---|
| (4) Feb. 7 | 0. Review of Proposals and Evaluation by the class. |
| (5) Feb. 14 | 1. Objectives of the Marketing Plan<br>2. Product (Process, Service) Description<br>2.1 Technical Description (Functions and Features)<br>2.2 Customer Benefits<br>2.3 Application Guidelines |
| NOTES: | a) Assume you are the Marketing Manager of Division X or Company Y charged by the President to prepare this plan<br>b) Emphasize the customer benefits section (What does the product do for me?)<br>c) Product is defined (Webster, p. 16) as the total package of benefits the customer receives when he/she buys (functional utility, technical assistance, application engineering, product service, quality and reliability, etc.)<br>d) Industrial marketing customers are sophisticated. Be specific in your claims of benefits and avoid general claims or "image" A&SP. |
| (7) Feb. 28 | 3. Environmental Analysis<br>3.1 Environment<br>Describe only those trends (economic, political, financial, social, technological, regulatory) which may influence your targeted markets.<br>Examples: (1) use of robots in welding for safety and environmental reasons. (2) Japanese lead in quality, U.S. must catch up.<br>3.2 Industry Structure<br>Describe the structure of the targeted industries and how this structure drives the market for your product.<br>Examples: (1) A few "early adopters" such as GM, GE validate a product. (2) Investment base determines the ROI of utilities.<br>3.3 Competition<br>Look at both direct and indirect competition. Example: Robots in USA versus manual assembly in developing countries. |

| (Week) Date | Sections of Marketing Plan |
|---|---|
| (9) Mar. 14 | 4. Market Analysis<br>4.1 Market Segmentation and Selection<br>Selectivity should be the criterion of your plan, since your resoures are limited. Start with the most promising segment, then expand to others.<br>4.2 Market Size and Growth Rate<br>This is a quantitative analysis of each market segment. Determine both size and growth rate. |
| NOTES: | a) We are concerned here with total served market size, not with your market share. This will be discussed in the next section, since it depends on strategy and resources.<br>b) Projections should be made until 1992 as a minimum (you want to be in business for a long time!).<br>c) Segment selection should be justified analytically. |
| (11) Apr. 4 | 5. Strategy<br>5.1 Product Strategy — May be combined<br>5.2 Market Strategy — in one subsection<br>5.3 Pricing Strategy<br>5.4 Market Share, as a function of time<br>5.5 Sales=Market x Market Share (by year, from 1987 to 1992)<br>5.6 Advertising and Sales Strategy and Plan<br>5.7 Technical Documentation and Customer Training Plan, including updates |
| (13) Apr. 18 | 6. Sales Plans, Resources, Risk Analysis<br>6.1 Distribution and Sales Plans<br>How many offices, salespersons or distributors? How much will these cost annually, plus training expenses?<br>6.2 Orders and Sales Forecasts<br>6.3 Resources Needed (people, dollars, other)<br>6.4 Milestones (by year and quarter)<br>Assume your plan will be approved on December 10, 1986 and that you will start implementation on January 2, 1987.<br>6.5 Risk Analysis (economic, commercial, environmental, technical)<br>6.6 Contingency Plan<br>6.7 Conclusions and Recommendations |
| NOTES: | a) This is a marketing plan, not a business plan. Therefore, we are only concerned with sales and marketing expenses.<br>b) Resources needed are only those for marketing and selling the product (not for R&D, engineering, manufacturing, finance).<br>c) Orders and Sales forecasts will differ depending upon the length of the production cycle. |

| (Week) Date | Sections of Marketing Plan |
|---|---|
| | d) Contingency plans should indicate what you intend to do if the event occurs. Example: New oil crisis in 1988, gasoline shortage, automobile production cut back by 50%. Sell robots for solar energy panels rather than for welding auto bodies. |
| (16) May 9 | 7. Final Report |

NOTES:

a) The final report will include all the previous 6 sections with appropriate changes.
b) The report should have in addition, a Title Page, Table of Contents and Executive Summary (2 pages).
c) The Executive Summary will summarize very briefly the key ideas and data of the plan and present key conclusions at the end. Assume that some busy executives will read only this summary, not the entire plan.
d) All pages should be numbered consecutively, including tables and illustrations.

NTU SEMINAR

"THEORY AND PRACTICE OF TECHNOLOGICAL ENTREPRENEURSHIP:
THE RPI EXPERIENCE

SELECTED BIBLIOGRAPHY


1. Books on the Management of Technology, Innovation and Entrepreneurship
   - 1.1 Brian Twiss, Managing Technological Innovation, Pitman, 3rd edition, 1986.
   - 1.2 M.J. Martin, Managing Technological Innovation and Entrepreneurship, Reston (Prentice-Hall), 1984.
   - 1.3 R.A. Burgelman, M.A. Maidique, Strategic Management of Technology and Innovation, Irwin, 1988.
   - 1.4 H.I. Fusfeld, The Technical Enterprise, Ballinger, 1986.
   - 1.5 M.L. Tushman and W.L. Moore, Readings in the Management of Innovation, Pitman, 2nd edition, 1988.
   - 1.6 P. Kelly and M. Kranzberg, Technological Innovation: A Critical Review of Current Knowledge, The San Francisco Press, 1978.
   - 1.7 J.A. Timmons, New Venture Creation, Irwin, second edition, 1985.

2. Books on Corporate Entrepreneurship
   - 2.1 R.M. Kanter, The Change Masters, Simon and Schuster, 1983.
   - 2.2 G. Pinchot, Intrapreneuring, Harper and Row, 1985.
   - 2.3 P. Drucker, Innovation and Entrepreneurship, Harper and Row, 1985.
   - 2.4 D.L. Sexton and R.W. Smilor (editors), The Art and Science of Entrepreneurship, Ballinger, 1985.
   - 2.5 T.J. Kao, Entrepreneurship, Creativity and Organization, Prentice-Hall, 1989.

3. Articles on Subjects Discussed in the Seminar
   - 3.1 P.A. Abetti, "Technology: A Challenge to Planners," Planning Review, Vol. 12, No. 4 (July 1984), pp. 24-27, 45.
   - 3.2 P.A. Abetti, "Milestones for Managing Technological Innovation," Planning Review, Vol. 13, No. 2 (March 1985), pp. 18-22, 45-46.
   - 3.3 D.G. Marquis, "The Anatomy of Successful Innovations" in Reference 1.5 above, pp. 79-87.
   - 3.4 P. Jervis, "Innovation and Technology Transfer- The Roles and Characteristics of Individuals," IEEE Transactions on Engineering Management EM-22, 1975, pp. 19-27.
   - 3.5 M.A. Maidique and B.T. Zirger, "A Study of Success and Failure in Product Innovation," IEEE Transactions in Engineering Management EM-31, pp. 192-303.
   - 3.6 R. Stuart and P.A. Abetti, "Start-Up Ventures: Towards the Prediction of Initial Success," Journal of Business Venturing, 2, 197, pp. 215-230.
   - 3.7 P.A. Abetti and R.W. Stuart, "Evaluating New Product Risk," Research-Technology Management, Vol. 32, May-June 1988, pp. 40-43.

Bibliography, continued


3.8 P.A. Abetti and R.W. Stuart, "Entrepreneurship and Technology Transfer" in Reference 2.4 above, pp. 181-209.

3.9 H.B. Sykes, "The Anatomy of a Corporate Venturing Program: Factors Influencing Success," Journal of Business Venturing, 1, 1986, pp. 275-293.

3.10 L.A. Weiss, "Start-Up Businesses: A Comparison of Performances, Sloan Management Review (Fall 1981), pp. 37-53.

3.11 E.B. Roberts and C.A. Berry, "Entering New Businesses: Selecting Strategies for Success," Sloan Management Review (Spring 1985), pp. 3-17.

3.12 L.W. Lehr, "Stimulating Technological Innovation: The Role of Top Management," Research Management, 24, 1979, pp. 23-25.

3.13 R.J. Tuite, "Strategies for Technology-Based New Business Development," presented at the International Forum on Technology Management, Brussels, Belgium, July 17-19, 1989.

3.14 H.H. Stevenson and D.E. Gumpert, "The Heart of Entrepreneurship," Harvard Business Review, 63, March-April 1985, pp. 85-94.

# APPENDIX "E"

Harvard Business School course outlines

# ADVANCED MANUFACTURING & TECHNOLOGY POLICY

COURSE SYLLABUS

Spring 1989

HARVARD UNIVERSITY

GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

George F. Baker Foundation

Associate Professor Ramchandran Jaikumar
Morgan 8
495-6303

Professor Steven C. Wheelwright
Morgan 4
495-6054

# ADVANCED MANUFACTURING AND TECHNOLOGY POLICY
# SPRING 1989

Associate Professor Ramchandran Jaikumar and Professor Stephen C. Wheelwright.

1 Credit MBA Course offered in SPRING semester.

In the last few years two important developments in manufacturing management have occurred:

1. Global industrial competition has intensified, and

2. Microprocessor and computer based technologies have changed the nature of automation in manufacturing.

Taken together, information-intensive process technologies have become a critical competitive weapon in global competition.

In this course we will attempt to understand the underlying structure of these technologies and their implications for management. Decisions involving whether and how to adopt Advanced Manufacturing Technologies must be made in the context of a coherent Technology Policy. In order to fully understand this interrelationship we will examine the nature of this relationship in industries ranging from fabricated piece parts to continuous processes.

The course will have a modular structure where each module will cover material on some key technology. Over the entire course, students will be exposed to several key technologies including: computer integrated manufacturing, computer aided design, artificial intelligence, flexible manufacturing systems, as well as new forms of shop floor integration such as Just-In-Time systems and group technology.

During this course we will progressively study: (1) plants which are neither automated nor integrated, but hope to achieve integration through Just-in-Time systems and Group Technology; (2) plants with a fully computer-integrated manufacturing environment; (3) plants which have islands of highly automated flexible manufacturing systems; (4) the implications of these technologies for managerial control, marketing, purchasing, and the strategy of the firm.

CASE OUTLINE
Revised Version 11-17-88

**MODULE 1:** Manufacturing Structure and Strategy

1. January 9 - Lecture: The Evolution of Process Control
   From Filing and Fitting to Flexible Manufacturing: A Study in the Evolution of Process Control Working Paper #88-045
   (In case packet)
2. January 10 - Beretta (N9-687-044)
   (In case packet)
3. January 17 - Sturm Ruger (A) (0-686-007 Rev. 11/86)
   (In case packet)
4. January 18 - Providence Seal (A)
   (To be distributed separately)
5. January 23 - John Deere and Co.: CIM Planning at the Harvester Works (1-687-093 Rev.12/87)
   (To be distributed separately)
6. January 24 - Lecture: Manufacturing Structure & Strategy
   (No handout)

**MODULE 2:** Managing Intellectual Assets

7. January 30 - Great Lakes Forest Products Limited
   (To be distributed separately)
8. January 31 - Westinghouse (A)
   (To be distributed separately)
9. February 6 - VLSI (A)
   (To be distributed separately)
10. February 7 - Lecture on CIM
    (Handout - distributed in class)

**MODULE 3:** Flexible Manufacturing Systems and the Machine Tool Industry

11. February 13 - Industry Note & Technical Note
    (To be distributed separately)
12. February 14 - Yamazaki (A)
    (To be distributed separately)
13. February 20 - Hitachi Seiki
    (To be distributed separately)
14. February 21 - Okuma
    (To be distributed separately)

15. February 27 - Ex-Cell-O Corp. (B)
(To be distributed separately)

16. February 28 - Lecture: Postindustrial Manufacturing
(To be distributed separately)

**MODULE 4:** Semiconductor Industries & Technology Policy

17. March 13 - Industry Note & Lecture
(To be distributed separately)

18. March 14 - SEEQ Technology, 1984
(To be distributed separately)

19. March 20 - A Report on Competition and Learning in DRAMs
(To be distributed separately)

20. March 21 - Minebea
(To be distributed separately)

21. March 27 - VLSI (B)
(To be distributed separately)

22. March 28 - Sematech Lecture
(No handout)

**MODULE 5:** Technology Policy

23. April 10 - Ford of Europe
(To be distributed separately)

24. April 11 - John Deere (A)
(To be distributed separately)

25. April 17 - Group Exercise

26. April 18 - Group Exercise

27. April 24 - Sturm Ruger (B)
(To be distributed separately)

28. April 25 - Bekaert
(To be distributed separately)

29. May 1 - Yamazaki (B)
(To be distributed separately)

30. May 2 - Menichetti (B)
(To be distributed separately)

31. May 3 - Lecture
(No handout)

32. May 4 - FINAL EXAM

Developing and Managing Technology
Fall 1988
Kim B. Clark and Steven C. Wheelwright

# DEVELOPING AND MANAGING TECHNOLOGY: COURSE SYLLABUS

Developing and Managing Technology (DMT) examines the management of creating, developing and implementing new technology. The course focuses on the full range of activities from laying a foundation of technical knowledge in research, through creation of new product or process concepts, to the integration of marketing, manufacturing and engineering in the development process and finally, to commercial introduction of new products and processes. Most of the material is drawn from technology intensive settings where managing technology is a central aspect of competition. The issues in the course cut across functional boundaries; we deal with problems in human resources, marketing, manufacturing, engineering and technology. Using technology to create value and build advantage is a central theme in the course. Our concern is with long term strategy as well as the managerial skills and capabilities needed in effective practice.

This syllabus provides a brief overview of the teaching modules in the course, a synopsis of the cases and readings, daily assignment questions, and a statement of course requirements and grading policies. In preparing for class, please read the synopsis and module overview carefully. We will use the cases in specific ways in the course and we have tried to give you some guidance in your preparation so that class discussions can be focused and fruitful.

## REQUIREMENTS AND GRADING

Grading in this course will be based on class participation, a write-up of a computer exercise, and a final exam. The weights attached to each item are as follows:

| | |
|---|---|
| class participation | 40% |
| computer exercise write-up | 10% |
| final exam | 50% |

This course includes a short computer exercise in technology development that will be carried out in small teams. Each student will be required to submit a short (2-3 page) written analysis of the exercise. This is an <u>individual</u>, not a team, assignment.

We recommend that students purchase a copy of <u>Dynamic Manufacturing</u> by Hayes, Wheelwright, and Clark, available in the Coop. Other materials will be available through Baker 20 or passed out in class.

COURSE OVERVIEW

Developing and Managing Technology is divided into three parts. The first part of the course focuses on the nature of technology and technological change. We will develop a framework and vocabulary that will be used throughout the course. The second part of the course deals with the development of new products and processes, including the organization and management of specific projects and the integration of marketing, manufacturing and engineering. The final module focuses on linking product and process development to business strategy through the development and implementation of a technology strategy.

COURSE DESCRIPTION

PART I: THE NATURE OF TECHNOLOGY

Part I of the course includes five sessions on the nature of technology and the process of innovation and technological change. Our objective is to develop an understanding of what technology is, what forces underlie the process of innovation, and the issues one must confront in managing technological change.

| Date | Case(s)/Lecture |
|---|---|
| 08 September | Gunfire at Sea: A Case Study of Innovation |
| 12 September | Pilkington Float Glass (A)<br>Note on the Flat Glass Industry -- 1955 |
| 19 September | Advent Corporation (C) |
| 20 September | Medical Diagnostic Imaging |
| 26 September | Technology and Competition: Introduction to Product and Process Development |

PART II: THE DEVELOPMENT AND IMPLEMENTATION OF NEW PRODUCTS AND PROCESSES

Part II of the course is concerned with the transformation of technical knowledge and commercial insight into new products and processes. We focus on the problems of development, as well as on implementation. Information processing and problem solving are important themes in the module. The central problem in development is the integration of different kinds of knowledge, often located in different organizations, each of which may face somewhat different incentives and may speak a slightly different language. Our objective will be to understand what influence management has on the speed, cost and quality of the development process.

(Note: Part II of the course includes a computer exercise that will give student teams an opportunity to run a relatively complex development project. The exercise is based on a software program called SPACE MAX that simulates the development and building of a space station.)

| Date | Case(s)/Lecture |
|---|---|
| 27 September | Texas Instruments, Inc. Educational Products |
| 28 September | Plus Development Corporation (A) |
| 03 October | Plus Development Corporation (B) |
| 04 October | Laying the Foundation for New Product Development |
| 11 October | Sun Microsystems (A) |
| 12 October | R&D Management: Designing and Building a Space Station (A) |
| 17 October | Space MAX 2 |
| 18 October | Space MAX 3 |
| 24 October | Space MAX 4 |
| 25 October | Space MAX 5 |
| 31 October | Everest Computer: The Development of the SuperMOS Process |
| 01 November | Applied Materials |
| 07 November | Sun Microsystems (B) |
| 08 November | Honeywell Residential Division: New Product Development |
| 14 November | Ed Barron, Digital Equipment Corporation |
| 15 November | Product Development: Creating Superior Performance |

PART III: LINKING PRODUCT/PROCESS DEVELOPMENT TO BUSINESS STRATEGY

Part III of the course will address the management tasks of integrating the various dimensions of technology's contribution to competitive advantage into an overall technology strategy. Particularly important here will be interactions between functions, the integration of operating actions with strategic plans, and the development of organizational capabilities along lines that will encourage and support the realization of technology-based opportunities for competitive advantage. A particularly important theme in this final segment will be developing the organization's ability to learn. The role of the manager as leader, champion, motivator, and competitor also will be emphasized. In the final session, career opportunities in a technology-intensive environment will be addressed and discussed.

| Date | Case(s)/Lecture |
|---|---|
| 21 November | Biodel, Inc. (A) |

| | |
|---|---|
| 22 November | Ceramics Process Systems, Inc. (A) |
| 23 November | Reliance Electric Motor Division (A) |
| 28 November | General Electric Lighting Business Group: The High-Speed Horizontal Project |
| 29 November | Resotech, Inc. |
| 05 December | Bendix (A) |
| 06 December | Bendix (B) |
| 07 December | Claire McCloud |

## CLASS SCHEDULE AND ASSIGNMENTS

PART I: THE NATURE OF TECHNOLOGY

1. 08 September 1988

**Prepare:** *Gunfire at Sea: A Case Study of Innovation*

This reading is a classic description of the innovation process. It provides insight into both the characteristics of innovative individuals, as well as the context in which innovations occur and are implemented. Further, this case gives us the opportunity to see the relationship between the technical and the organizational dimensions of innovation.

**Questions:**

1. What is "continuous aim firing"? In what way did it differ from previous practice?

2. What explains the development of the continuous aim process by Scott in 1898? What were the most essential factors?

3. What is your evaluation of Sims and his approach to introducing change? What would you have done differently?

2. 12 September 1988

**Prepare:** *Pilkington Float Glass (A)* (9-672-069)
*Note on the Flat Glass Industry -- 1955* (9-672-070)

Reading: *Dynamic Manufacturing*, Chapter 2: "America's Manufacturing Heritage"

The Pilkington case describes the company and its involvement in the development of a new glass making process. The company must decide whether to continue with the project, a move that would require significant investment. As background to that decision, the case gives us a chance to look at the new technology and its relationship to established processes. The note on the flat glass industry in 1955 provides background information on glass making processes. You should spend the bulk of your time with the case, but use the note to develop some understanding of the technology.

**Questions:**

1. Compare the float glass process with established alternatives. How has the established method evolved? What changes does the float process introduce? What central issues in the float process remain unresolved at the time of the case?

2. What explains the involvement of Pilkington in the development of the float process? What is your evaluation of their approach to the new technology?

3. Should the board approve Alastair's request for $1.96 million to convert the redundant plate glass furnace?

3. 19 September 1988

**Prepare:** *Advent Corporation (C)* (9-674-027)

The Advent case examines the practices and policies of Henry Kloss, an innovative pioneer in the consumer electronics industry. This account of Kloss's experience gives us a chance to examine a particular model of the innovation process.

**Questions:**

1. What is the "Advent innovation process?" What is the relationship between technology and market information in that process?

2. What is your evaluation of the way that Advent (Kloss?) conceives of innovations, evaluates and develops them?

3. Can (should?) the Advent innovation process be institutionalized?

4. How should the projection-TV innovation be brought to fruition?

4. 20 September 1988

**Prepare:** *Medical Diagnostic Imaging* (9-684-030)

Reading: *Dynamic Manufacturing*, Chapter 3: "Thinking Long Term: The Capital Investment Process," especially pp. 89-95

This note describes the principle technologies used in diagnostic imaging. We will use the case as the basis for a discussion of technology analysis. The objective of the discussion is the development of a set of tools that we can use in analyzing and thinking about technologies in general. We will supplement the discussion with a brief lecture on technology analysis.

**Questions:**

1. Who are the customers of diagnostic imaging and what criteria do they use in evaluating alternative imaging technologies?

2. Compare the alternative technologies outlined in the note. For each one, identify:

a. the "core" concept(s) that distinguishes it from the others
b. the technical differences that follow from those core concept(s)

-- in particular, the key components and subsystems in the product
c. the differences in function and performance the set of technical differences creates -- and the different tradeoffs customers might make in evaluating them
d. the likely path of future development

5. 26 September 1988

**Prepare:** Clark, "Technology and Competition: A Framework"

**Lecture:** *Technology and Competition -- Introduction to Product and Process Development*

**Questions:**

1. What kind of innovation was:
a. float glass
b. NMR
c. projection television?

2. What are the characteristics of new product and new process situations that make them so difficult for organizations to change? (Be specific and cite examples.)

3. What principles should managers use to guide the development of new products and processes?

PART II: THE DEVELOPMENT OF NEW PRODUCTS AND PROCESSES

6. 27 September 1988

**Prepare:** *Texas Instruments, Inc. Educational Products* (9-683-001) Rev. 10/84

Reading: *Dynamic Manufacturing*, Chapter 10: "Laying the Foundation for Product and Process Development"

This case examines the development of a new consumer product based on speech synthesis technology. The case describes TI's approach to managing technology, including research, development and implementation. Business Week described the product as a "breakthrough" that illustrates how TI "is solving much of the problem of stimulating and managing innovation in a large company."

**Questions:**

1. How would you evaluate the systems and organization TI uses in managing technology and innovation? In particular, in what specific ways was the development of the Speak and Spell product influenced by the character of TI's organization and management system? (For example, what was the role of marketing in the development of Speak and Spell?)

2. Given the situation in May 1978, should Gene Frantz have introduced the product at the Consumer Electronics Show? If so, at what price? If not, what should he have done?

7. 28 September 1988

**Prepare:** *Plus Development Corporation (A)* (9-687-001)

This case describes the development of the 10MB version of Hardcard, a hard disk drive on an expansion board for use in the IBM PC. The product and process were developed by PLUS (a subsidiary of Quantum Corp.) in partnership with JEMCO, a Japanese company. The case raises the issue of design for manufacturability. In addition it opens up issues of development philosophy and organization and raises questions about the long term viability of this kind of partnership.

**Questions:**

1. What is different about the way the Japanese partner approaches product and process development and the way development is approached at Quantum?

2. How important is it to stay on schedule in such a product development effort? Why?

3. How far behind do you think the development effort is? What should PLUS do about it? Develop a plan of action for the next several months.

4. Longer term, what does PLUS bring to the development effort and the business? Does the partnership provide a foundation for a viable long-term competitive position?

8. 03 October 1988

**Prepare:** *Plus Development Corporation (B)* (9-688-066)
Handed out in class

**Questions:** Handed out in class

9. 04 October 1988

**Lecture:** *Laying the Foundation for New Product Development*

Reading: Rothwell and Gardiner, "The Role of Design in Product and Process Change"
*Dynamic Manufacturing*, re-read Chapter 10

**Questions:**

1. As you review the cases we've had thus far in the course and other product and process development situations of which you have knowledge, what are the primary "types of problems" such efforts encounter? That is, what are the common characteristics of such situations that an organization must address to be successful?

2. How does the extent of change in the new product/process impact the nature of the issues with which management must deal in a development effort? In particular, how do the requirements for success on a "radical" development effort like Speak and Spell and Hardcard differ from the requirements for success on a "next generation" effort?

3. A common response to mapping and its potential is "Don't organizations already do this? Unfortunately, most don't. Why might that be the case?

10. 11 October 1988

**Prepare:** *Sun Microsystems (A)* (9-686-133) Rev. 8/86

In this case, we'll look at a set of issues that show up in most companies and industries, but because of short product life cycles, are intensified in the electronics industry. Scott McNealy has to provide some guidance to his management team regarding the introduction of the Carrera workstation. A September 10th introduction would help Sun's financial and market position, but could backfire if they aren't able to ramp up manufacturing or ship reliable products. Alternatively, they could delay the announcement, but they may suffer in market share and reputation, especially if someone else announces a competing product.

**Questions:**

1. What is your assessment of product development at Sun? How did they arrive at their current approach? Should they try to change their approach to the Carrera development effort at this point?

2. What should Sun do about the Carrera introduction? If they decide to delay, what specific things should be done before they decide to introduce? If they go ahead with the September 10th date, what can they do to minimize the risks?

3. In general, how could Sun improve its product development process for the Sun 4? How could they avoid some of the problems they now face? What procedures (management approach) should they use to make those improvements? (Be specific as to who should direct that effort, how and when it should be done, and how improvements would be "institutionalized" or "captured.")

11. 12 October 1988

**Prepare:** *R&D Management: Designing and Building a Space Station (A)* (9-686-019) Rev. 3/88

This class introduces the computer simulation exercise in which you will work in a small team (4-5 people) to design, build, and operate a space station. Detailed instructions for the exercise, including a

schedule and a description of the deliverables, will be provided in a separate handout two weeks prior to this class. At that time we will form teams. Please note that the assignment for today's class is a team assignment. During class we will explain the rules governing the exercise, discuss the assignment and team organization, pass out and demonstrate the software, and answer questions.

**Assignment:**

Each team should prepare a preliminary budget and construction plan and hand them in at the beginning of class. All of the information you need to complete this assignment is in the case. Your budget and plan should include the following information:

1. Capital costs of all the modules you expect to need in the completed station.

2. Schedule for getting modules and material into orbit and the station built. Please provide two specific time estimates:

- time until shuttles are no longer needed on station, in orbit;
- time until the station is completed.

3. Cost of getting modules into orbit, including launch costs, shuttle lease costs, and other payments to NASA.

4. Any other costs.

Your total budget for this project is $3.3 billion, and you have a time limit of 90 days.

12. 17 October 1988

**Prepare:** Space MAX -- session #2

This is designed to be a short class, and not all members of the team need attend. In this class, teams will turn in the second deliverable: a feasible design. We will pass out additional software (this is the ACTUAL file to be used in the "real" launch, construction, and operation of the space station -- please see the case for details), and answer (some) questions.

13. 18 October 1988

**Prepare:** Space MAX -- session #3

There is no regularly scheduled class session today.

14. 24 October 1988

**Prepare:** Space MAX -- session #4

This is the first of two de-briefing sessions. In this class, teams will turn in the Project Performance Summary (this is included in the exercise handout). In addition, teams will also turn in overhead slides of their final design and the station as constructed. We will discuss the results, with particular focus on what the teams learned.

15. 25 October 1988

**Prepare:** Space MAX -- session #5

This is the final de-briefing session. Students should hand in the individual written assignment at the beginning of class. In class we will discuss the way the teams organized and managed the project. Based on the Project Performance Summary and other information developed in the first de-briefing session, we will attempt to identify possible connections between team performance and team organization and management.

**Assignment:** [This is an individual assignment.] Please write a 2-3 page paper that deals with the following questions:

1. What were the distinctive characteristics of your team's approach to managing the project? (Please concentrate on the 3-4 most critical elements of the approach -- we have in mind things like the nature of decisionmaking, patterns of specialization, the way problems were solved, dealing with contingencies, how you learned, and so forth.) What impact did they have on your performance?

2. What would you do differently the next time you are faced with managing a development project?

16. 31 October 1988

**Prepare:** *Everest Computer: The Development of the SuperMOS Process* (9-685-085) Rev. 10/88

This case presents the situation facing the Engineering Computer Division of Everest Computer in the development and launch of a new semiconductor process. The chip development effort produced success in the prototype stage, but difficulties have plagued the project as it moved toward commercial production. Although the case raises some strategic issues, we shall focus on the the yield problems and what has to be done to get the process implemented.

**Questions:**

1. Yield problems are common in the semiconductor industry. They are often caused by things like contaminated materials, poorly aligned circuit elements, improperly executed production steps, dust particles, and so forth. But the SuperMOS process seems to be especially troublesome. What explains the high level of difficulty with yields in this case?

2. What is your evaluation of the approach Everest has taken in trying to solve the yield and production problems in the SuperMOS process? (It might be useful to begin answering this question by trying to identify what the main elements of the approach have been.)

3. What should Marvin Kellogg, Dan Dryden and the other managers involved do? Develop a plan of action for solving the problem. Be sure to give consideration to how to organize the effort, as well as what to do first, second, third and so on.

17. 01 November 1988

**Prepare:** *Applied Materials* (2-688-050)
Rev. 10/88

Reading: *Dynamic Manufacturing*, Chapter 5: "Measuring Manufacturing Performance," pp. 148-153

Applied Materials is a developer and producer of very high-tech semiconductor manufacturing equipment. The case describes the development projects that the company used to design and start up production of three subsequent generations of the same product family. It provides an opportunity to assess the differences in the environment across three product generations and their implications for the development projects. In the final portion of the case, the third generation product family is described, and the current development effort, which is only partially completed, is discussed. Management faces the issue of whether or not they should try to shorten the cycle time in completing this development project or stick with the original schedule developed at the project's initiation.

Questions:

1. What accounts for the major differences in timing, resource utilization, and results between the first and second product generations? What is your evaluation of the division's own internal analysis of what it learned in those two development efforts?

2. How do you think the third generation development project is proceeding? Is it ahead of schedule? Why? How does it differ from the first two projects?

3. What recommendations would you make to Dan Maydan concerning the issues he faces at the end of the case?

18. 07 November 1988

**Prepare:** *Sun Microsystems (B)* (9-686-134)
Rev. 5/88

This cases examines the problem of introducing a new product into manufacturing, and managing the "ramp-up" process to achieve volume production. A central question in the case is the role of the ECO

(engineering change order) in the company. The ECO issue is part of a larger question about the existing new product development process at Sun, and the merits of proposed alternatives.

**Questions:**

1. Describe the main features of Sun's approach to the development and introduction of the Carrera. What is your evaluation of that approach?

2. What explains the pattern of ECOs you observe? What role do (should?) ECOs play at Sun?

3. What is different about the options outlined in Exhibit 13? Why has Coe recommended the second option in both location and staffing?

4. What should Scott McNealy do? What recommendations would you make to Sun regarding both ECOs and the Pilot Production issues?

19. 08 November 1988

**Prepare:** *Honeywell Residential Division: New Product Development* (1-689-035) Rev. 10/88

Reading: Takeuchi & Nonaka, "The New New-Product Development Game"

This case examines three product development projects conducted at Honeywell's Residential Division. The three projects represent different approaches and philosophies, deal with different kinds of technologies and yield different results. The case raises the issue of the match between the problem the development process is supposed to solve, and the nature of the process. Further, the senior manager involved must deal with the question of implementing changes in the approach based on what is learned across a series of projects.

**Questions:**

1. What are the salient features of the traditional development process at Honeywell Residential? What strengths and weaknesses does it have?

2. Compare the three development projects discussed in the case. What explains the differences in performance you observe? (Note: At this point it might be useful to think about how one ought to compare projects. What are the relevant dimensions and criteria?) What lessons should Molson draw from your analysis?

3. What is your evaluation of the new direction suggested for product development (e.g. new procedures for product sourcing and product certification)?

4. What should Molson do? Develop a detailed plan of action.

20. 14 November 1988

**Guest Lecture:** Ed Barron
Manager, Low End Disk Systems
Digital Equipment Corporation

21. 15 November 1988

**Lecture:** ***Product Development: Creating Superior Performance***

Reading: *Dynamic Manufacturing*, Chapter 11: "Managing Product and Process Development Projects"

**Questions:**

1. Why is the management (and improvement) of product and process development so difficult for most organizations?

2. What guidelines and advice would you give to a firm and its managers about developing a competitive advantage in product and/or process development?

3. How should a firm go about changing its competence at product or process development, assuming it has decided to do so? Who should do what?

PART III: LINKING PRODUCT/PROCESS DEVELOPMENT TO BUSINESS STRATEGY

22. 21 November 1988

**Prepare:** *Biodel, Inc. (A)* (8-684-001)

Oscar Feldman faces a complex, but exciting set of choices. Decisions about what direction to take his company involve more than an assessment of the market opportunities. Feldman also needs to understand Biodel's existing capabilities, and the capabilities required by the diverse opportunities the market presents. Understanding those capabilities (and how they might be acquired) requires that one understand the policies, practices and procedures that create them.

**Questions:**

1. What are the critical capabilities in cell biology, immuno-diagnostics, and genetic engineering? What distinctive capabilities does Biodel have?

2. What opportunities seem most attractive? Why?

3. What should Oscar Feldman do about product focus, finance and the four scientists? In answering this question, develop a plan that identifies 1) what steps to take over what period of time, 2) what is

most critical, and 3) how to deal with contingent events. Be prepared to justify your choices.

23. 22 November 1988

**Prepare:** *Ceramics Process Systems, Inc. (A)* (9-687-030)

Clayton Christensen will be in class today to discuss his experience in managing a science-based company from its inception.

The case describes the problems facing Clayton Christensen, co-founder and CEO of a small, startup company in the ceramics industry. Founded to capitalize on materials science research done at MIT, CPS employs several outstanding young scientists whose experience is largely in university research laboratories. Christensen, with a background in economics and business strategy, must decide how to go about solving several pressing problems in the company's first R&D project. Further, general questions of how to organize and direct the research and development process need to be addressed.

**Questions:**

1. What are the problems facing the substrate project? What are the underlying sources of the problems?

2. What should Christensen do about West's proposal?

3. What are the implications of the substrate project experience for the problem of managing the research laboratory at CPS in general? What should Christensen do?

24. 23 November 1988

**Prepare:** *Reliance Electric Motor Division (A)* (9-678-067)

The Reliance case focuses on a decision about whether to give final approval to a redesigned DC motor. Understanding and making that decision requires an assessment of likely future developments in customers, markets, and the technology. The case thus provides the basis for examination of the linkage between competition and Reliance's technology strategy.

Please use the following supplemental data in evaluating the options open to Norm Harbert. [Note: The first product is the Reliance AC counterpart to the DC product; the second is the old Reliance DC design, about to be replaced by a new design; the third is the new Reliance DC design that has just been developed (and that Tsivitse is questioning); and the fourth is what the existing Reliance product (and the redesigned product) competes against.]

Standard Manufacturing Costs

| Product | Materials $/unit | Direct Labor Hours/unit | Direct Labor Cost $/unit |
|---|---|---|---|
| Reliance E-Line AC Motor 256T | $104 | 1.3 | $35 |
| Reliance RPM DC Square Frame 259 AT | $344 | 19.0 | $235 |
| Reliance Mark II DC Proposed Design Round Frame 250 | $296 | 8.5* | $105 |
| Competitors' DC Rolled Solid Ring 259 AT | $310 | 14.0 | $175 |

*Assumes automation of winding operations for armature and coil and use of other automatic equipment.

**Questions:**

1. What is your evaluation of where the design project team has ended up? Why did they abandon the square frame and move back to the more traditional design? What are the strengths and weaknesses of what they've proposed?

2. What are the pros and cons of the Tsivitse proposal? What are the pros and cons of going with what the design team has already proposed?

3. What recommendations would you make to Harbert? If you think he ought to pursue the Tsivitse approach, how will he decide in three months what is the appropriate action?

25. 28 November 1988

**Prepare:** *General Electric Lighting Business Group: The High-Speed Horizontal Project* (1-689-038) Rev. 11/88

Reading: Adler, "New Technologies, New Skills"

This case describes the evolution of process technology in GE's Lighting Business Group, tracing it from a period of strong process development in the 1950s to one of decentralized, dispersed manufacturing engineering capability in the late 1970s (focusing primarily on incremental improvements), and finally to a more centralized but more selectively focused activity in the early 1980s. The specific issue addressed in the case is the achievement of an order-of-magnitude improvement in GE's production processes and how best to divide and focus technical resources among plant-level staff, corporate (group)-level staff, and external suppliers.

This case enables us to explore the way in which organization structure and near-term operating approaches affect longer-term evolution of technical capabilities and overall competitive position. We will discuss some of the differences between companies that have in-house process and equipment development capabilities and those that do not, as well as differences between Japanese equipment supplier approaches to major customer programs and those of U.S. equipment suppliers.

**Questions:**

1. What are the critical capabilities in process technology in the lighting business? What explains LBG's position in process technology in the mid-1980's?

2. What is your evaluation of their approach to regaining lost ground? Is the process technology strategy likely to lead to a competitive advantage in the future? Why or why not?

3. What should Bob Nardelli do about the high-speed horizontal lines and the near term issues of implementation? What will be critical in putting the new, upgraded process on a path of continual improvement? Develop a detailed plan of action; be prepared to justify it.

26. 29 November 1988

**Prepare:** *Resotech, Inc.* (9-688-017)

This case examines decisions facing a small, new company in the magnetic resonance imaging industry. After successfully launching the product, the firm must evaluate attractive opportunities for next generation products. The decision raises issues of both strategy and the operations of the firm: R&D, marketing, and manufacturing activities.

Note: Total shipments in Exhibit 1 are 327.

1. Evaluate Resotech's approach to management and technology strategy. What strengths and weaknesses do you find?

2. Should Resotech accept the CHC contract? Be prepared to defend your decision with evidence on the financial, technical, commercial, and operational implications of the contract.

3. Given your answer to question number 2, develop a plan for technical and commercial operations at Resotech over the next three years.

27. 05 December 1988

**Prepare:** *Bendix (A)* (9-684-035)

Reading: Foster, "Boosting the Payoff from R&D"

The Bendix (A) case provides background on the machine tool industry and several of the forces that are driving its evolution and revolution. It also describes the organizational units at Bendix involved in machine tools and the way in which product technology and its evolution is viewed by top management in the Automation Group. This case provides an opportunity to examine how Bendix has organized and committed itself to address its changing environment and, hopefully, to develop a competitive advantage involving technology.

**Questions:**

1. What are the major forces in the machine tool industry? How are those changing?

2. What are the implications of those industry changes for the Bendix Automation Group?

3. What are the significant elements of the Automation Group's approach to technology? What will be critical to the success of this approach?

28. 06 December 1988

**Prepare:** *Bendix (B)* (9-684-036)

In the Bendix (B) case, we have a chance to examine an approach to technology, its development, and its role in competitive advantage. The Wiedemann Quantum 2000 represents a new product development project that was tackled with a very different approach from that traditionally used by the Automation Group. The case describes how the product development effort was modified to shorten cycle times and to change the risks and pressures taken on by the organization.

**Questions:**

1. What have been the major steps in the product development effort for the Wiedemann Quantum 2000? What is your evaluation of that effort?

2. What are the major risks and challenges that you see facing Bendix Automation with regard to the Q2000 at the end of 1983? What recommendations would you make regarding those risks and challenges?

3. What should be the primary guidelines that set the direction and path that Bendix Automation takes over the next several years with regard to specific product development efforts and the more general development of their technological capability? What actions would you recommend to keep them on that path?

29. 07 December 1988

**Prepare:** *Claire McCloud* (9-680-030)

This case examines many of the substantive issues that we will have discussed in the course: the nature of technology, the role of the general manager in developing technology, managing the development process, the tension between technical and non-technical domains in a technology-based firm, and so forth. But the case also introduces some of the personal issues that will confront you as your career develops: how much you need to know about the technical aspects of your work, how to acquire skills and knowledge that you do not have, and what special problems developing and managing technology may create for you. We will discuss both sets of issues (and their interrelationship) in class.

**Questions:**

1. What skills and abilities should the new division manager have if Optical Wavelength Specialists is to be "firmly established" and successful in the fiber optics market?

2. Should Claire McCloud accept the Colonel's offer? What issues should she consider in making the decision? What are the most pressing long and short terms tasks she needs to address?

3. Assuming, for purposes of discussion, that Claire accepts the position, what should she do? How can she develop the skills, knowledge, and tools required for her to be successful? What kind of support can and should she count on from others? How can she get it?

**Technology and Operations Management**
**Doctoral Seminar**
**Fall 1988**
**Professor Kim B. Clark**
**Professor Steven C. Wheelwright**

**The doctoral seminar in the POM Area for Fall 1988 is organized around four broad areas of research:**

1) Operations Management

The topics in this area include process analysis, the human/ organizational dimension of operations, systems for coordination, and controlling and improving operating performance.

2) Operations Strategy

This area covers the concept of operations strategy, capacity, design of the operating system (e.g., facilities network, focus), vertical integration and supplier relationships, and process technology.

3) Technology Management

Our focus here is on the innovation process, planning for new technologies, managing research, managing development of new products and processes, and implementing new technologies.

4) Technology Strategy

The final area deals with the nature of technological change, technology and competition, and the integration of technology and business strategy.

Students should be aware of two aspects of this definition of the field. First, the dividing lines between these areas of research are not sharply drawn. There is a strong interaction across areas. For example, a critical issue in operating performance is the way the firm designs and develops new products. Likewise, technology strategy is intimately connected to the way the firm manages research. Second, our focus is not restricted to manufacturing businesses. We will examine operations and technology in services as well. Indeed, one of the important themes in seminar is the blurring of the distinction between manufacturing and service businesses in the management of technology and operations.

The reading list in each area is extensive, but is not intended to be comprehensive. It should be the basis for preparing for the special field examination, but specialization in a particular area will require further reading and exploration. In the seminar we will provide an overview of each area and examine a small number of issues in depth. Our intent is to introduce you to the literature, the methods of analysis, and the issues in these fields.

There is no final exam in this course, but students are expected to write a substantial paper on a topic related to one of the four areas of research. This paper may fall in one of three categories: 1) a critical review of a body of literature; 2) empirical analysis of a particular issue; or 3) a theoretical treatment of a problem. In addition to the major paper, students are required to prepare four short papers (no more than five pages per paper). Each of the short papers will critically review a piece of research in one of the four areas we will study. The topics for the short papers will be assigned by the instructors.

# Basic Readings in Technology and Operations Management

## I. Operations Management

### A. *Historical and Conceptual Perspectives*

#### 1. Historical Development

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#### 2. Manufacturing and Service Concepts

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B. *The Technical Dimension: Process Analysis*

1. Manufacturing and Service Processes

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Browne, J., et al. (1982). "Classification of Flexible Manufacturing Systems." The FMS Magazine.

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C. *The Human/Organizational Dimension*

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# APPENDIX "F"

Technology and Innovation Management Survey (Academy of Management)

This survey presents the summary of 19 courses on Management of Technology, collected by Judy Kamm of Bentley, in the US and Canada.

# TEACHING TECHNOLOGY AND INNOVATION MANAGEMENT: MBA and EMBA COURSES

## Overview

Each Roman numeral in the outline is a separate computer file.

I. THE SAMPLE

- A. Descriptive List
  1. Item number (alphabetical order by author)
  2. Author
  3. Course Title
  4. Department
  5. Program or School
  6. College or University
- B. Demographics
  1. Sample size
  2. Number of Management vs. Non-management (marketing, engineering, etc.) Courses

II. COURSE OBJECTIVES

- A. Consolidated list taken verbatim from syllabi, with identifying item numbers for reference
- B. Categorization of objectives

III. TOPICS

- A. Consolidated list taken verbatim from syllabi, with identifying item numbers for reference
- B. Categorization of topics

IV. MATERIALS

- A. Texts and Readings Books
  1. List of those used: author(s), title, publisher and date
  2. Number of courses using this type of material primarily
- B. Cases
  1. List of those used, referenced as above
  2. Number of courses using this type of material primarily
- C. Articles
  1. List of those used, referenced as above.
  2. Number of courses using this type of material

primarily

D. Software (Videos, films, computer simulations, etc.)
   1. List of those used, referenced as above.
   2. Number of courses using this type of material

V. ASSIGNMENTS

A. Papers
   1. Types (Case Analysis; Library Research; Field Project reports)
   2. Number of courses using as primary means of evaluation

B. Tests
   1. Types
   2. Number of courses using as primary means of evaluation

C. Simulations
   1.Number of courses using as primary means of evaluation

# TEACHING TECHNOLOGY AND INNOVATION MANAGEMENT
## MBA and EMBA COURSES

## I. The Sample

### A. Descriptive List

I.D. Number #1
Author Philip Anderson
Course title Management of Innovation and Technological Change
Dept. Management
Program School of Management
University Cornell University

#2
Dr. Graham Astley
Administrative Intergration
Management
College of Business Administration
Pennsylvania State University

#3
Dr. Graham Astley
Seminar in Corporate Strategy
Management
College of Business Administration
Penn State University

#4
A.J. Bailetti : J.R. Callahan
Technology and Business Strategy
Management
School of Business
Carelton University

#5
Professor Stephen Barley
Technology and the Worker
Managemment
Cornell University

#6
Horst O. Bender
High Technology Marketing
Marketing
MBA and EMBA Program
Case Western Reserve University

#7
Sushil Bhalla
Management of Technology
Management

The Wharton School
University of Pennsylvania

#8
Dr. P.H. Birnbaum
Management of Technology and Innovations
Management
Graduate School of Business Administration
University of Southern California

#9
Lewis M. Branscomb and Harvey Brooks
Science and Technology Strategies for Competitiveness
Government
JFK School of Government
Harvard University

#10
Robert A. Burgelman
Managing Corporate Technology and Innovation
Management
Graduate School of Business
Stanford University

#11
Kim B. Clark
Developing and Managing Technology
Management
Harvard Business School
Harvard University

#12
Richard Goodman
Technology, Strategy and Entrepreneurship in Emerging Corporations
Management
Graduate School of Management
University of California, Los Angeles

#13
Dr. William F. Hamilton
Technology Management
Management
The Wharton School
University of Pennsylvania

#14
Mariann Jelinek, Ph. D.
Advanced Technology and Strategy
Management
The Weatherhead School of Management
Case Wesern Reserve University

#15
Judith B. Kamm
Management of Innovation
Management
MBA Program
Bentley College

#16
Harvey F. Kolodny
New Work Organization Designs
Management
Faculty of Management Studies
University of Toronto

#17
Gerhard O. Mensch
Innovations Management Issues
Management
The Weatherhead School of Management
Case Western Reserve University

#18
Grover Starling
The Management of Advanced Technology
Management
School of Business and Public Administration
University of Houston-Clear Lake

#19
Eric Von Hippel
Introduction to Innovation
Management
Sloane School of Management
Massachusetts Institute of Technology

B. Demographics

1. Sample size: 19

2. Number of management courses: 17

3. Number of non-management courses: 2 (Marketing, Government)

TEACHING TECHNOLOGY AND INNOVATION MANAGEMENT:
MBA and EMBA COURSES

II. COURSE OBJECTIVES

#1
NA

#2
NA

#3
NA

#4
The objectives of the course are to study the integration of technology into business strategy and to develop a business plan for an actual technology based business opportunity. The course focuses on the management of change and of technology for competitive advantage.

#5
NA

#6
NA

#7
To examine the innovation process within technology-based organizations and the forces affecting the nature and rate of industrial innovation.

#8
1. An understanding of technology on its own terms.

2. An examination of the relationships among technology, decision making, and management.

3. A clarification of what technology means in the strategies of firms and nations.

#9
NA

#10
In this course, as in many management situations, there are multiple and occasionally conflicting objectives. These objectives include the following:

1. To develop an awareness of the range, scope, and complexity of the phenomena, issues, and problems related to technological innovation and internal entrepreneurship.

2. To develop an understanding of the "state of the art" of managing technological innovation and internal entrepreneurship.

3. To develop insight concerning the skills necessary to be effective as a general manager in the innovation process.

4. To develop a conceptual framework for assessing and auditing the innovative capabilities of a business organization.

5. To develop insights into the conditions under which particular structural arrangements and systems are likely to facilitate the emergence and management of technological innovation and internal entrepreneurship.

6. To offer some practice in defining and working out strategic management problems related to technological innovation and internal entrepreneurship.

#11
NA

#12
NA

#13
NA

#14
1. To develop an understanding of current and developing advanced technologies for business operations, especially manufacturing.

2. To identify the strategic issues these technologies pose for the firm.

3. To consider the implications and consequences of different

strategic choices.

4. To explore some implementation issues associated with advanced technologies.

5. To consider how the manufacturing experience is applicable or adaptable to inform non-manufacturing business experience with the new technologies.

#15

Organizational innovation is the process of generating ideas new to their source and making decisions about these ideas, resulting in something useful. The main objective of this course is to develop your ability to make good innovation decisions. Good innovation decisions are those that enable you to achieve your organization's as well as your own objectives.

More specifically, this course is designed to help you to answer for yourself the following questions:

1) What organizational goals could best be met and problems solved by innovating?
2) What types of innovation are available?
3) What resources are needed to stimulate new ideas?
4) How does management get involved in testing the feasibility of new ideas?
5) How should new ideas be proposed?
6) What criteria should be used in making decisions about innovations?
7) How can the commitment of the entire organization be gained for the innovation decision?
8) What is management's role in finalizing innovation?

#16

On completion of this course it is expected that students will have:

1 Thought about the values that underline organizational arragements and related those values to organizational philosophies, new technologies, systems, structures, processes and outcomes;

2. Explored the problems and the perspectives associated with contemporary work organization and examined alternative ways of organizing in these situations;

3. Come to understand the new forms of work organization that have begun to arise in Canada and abroad;

4. Examined principals of job and organization design and

studied their applicability to design and redesign situations.

#17
NA

#18
NA

#19
NA

TEACHING TECHNOLOGY AND INNOVATION MANAGEMENT:
MBA and EMBA COURSES

III. TOPICS

#1

PART 1: THE ECONOMICS OF INNOVATION AND TECHNOLOGICAL CHANGE

PART 2: MANAGING THE INNOVATIVE FIRM

PART 3: ORGANIZING THE INNOVATIVE FIRM

PART 4: TECHNOLOGICAL POLICY FOR INDUSTRIES AND NATIONS

#2

I. STRATEGY FORMULATION

1. STRATEGY AND ENVIRONMENT
2. BUSINESS-LEVEL STRATEGY
3. TECHNOLOGY STRATEGY
4. CORPORATE-LEVEL STRATEGY

II. STRATEGY IMPLEMENTATION

1. ORGANIZATIONAL DESIGN
2. MANAGING POWER AND POLITICS
3. STRATEGIC PLANNING AND CONTROL
4. HUMAN RESOURCE MANAGEMENT

#3

NA

#4
NA

#5
TOPICS

MODULE 1: GLOBAL ISSUES IN THE STUDY OF TECHNOLOGY AND WORK

A. Introduction to Class: What is Technology?

B. Conceptual Dilemmas: Technological Determines and the Doctrine of Materials

C. Overarching Trends I: Occupational Shifts

D. Overarching Trends II: Unemployment

MODULE 2: TECHNOLOGY, THE INDIVIDUAL, AND THE JOB

A. The Man-Machine Interface

B. The Social Construction of the Machine

C. The Social Psychology and Sociology of Automation

D. Deskilling, the Alternate View

MODULE 3: TECHNOLOGY AND THE WORKGROUP

A. Socio-Technical Systems.

B. Technological Subcultures

MODULE 4: TECHNOLOGY AND OCCUPATIONS

A. Technology and White Collar Work

B. Professionals and Technological Change

MODULE 5: MANAGING TECHNOLOGICAL CHANGE

A. Managing Technological Change I

B. Managing Technological Change II

C. Examining a Technological Change

#6

| | |
|---|---|
| 1 | Introduction and Overview |
| 2 | The Technological Dimensions of Competitive Strategy |
| 3. | Competition in a Dynamic Economy |
| 4. | Industrial Conversion Framework: A Conceptual Model for Innovative and High Tech Products |
| 5. | Assessing Product and Process Innovations via the Industrial Conversion Framework |
| 6. | The Process of Innovation: Basic Issues and Actors |
| 7. | Corporate and Marketing Strategy in High Technology Firms |
| 8. | Market Driven New Product Development |
| 9. | Assessing Markets for High Technology Products |
| 10. | The Role of Scientific and Technical Information in High Tech Industries and Markets |
| 11. | Managing Strategic Change: Market-Oriented Project Management |
| 12. | Implementing the Marketing Program: Marketing Mix Issues |
| 13. | Implementing the Marketing Program: Process Issues |
| 14. | The Role of Government in Innovation and High Tech: Supply and Demand Issues |
| 15. | The International Marketplace for High Tech Products |
| 16 | Managing a High Tech Business: Practical and Implementation Issues (Guest Speaker) |

#7
o Technological innovation in the U.S.
o Emerging vs. Established Technologies
o Strategic Responses to Technological Change
o The Dimensions of Technological Innovation
o Technological Forecasting and Assessment
o Technology as a Strategic Corporate Resources
o Technology Strategy and Planning
o Issues and Options in R&D Management
o Organizing for Innovation
o Technological Venture Development

#8
o U.S. Technology and Competition
o Industrial Competition and Competitive Advantage
o Technology and Competitive Advantage
o Technological Forecasting
o Differentiation Generic Strategy
o Managing the Technical Effort
o Cost Minimization Generic Strategy
o Strategic Relationships Between Manufacturing and New Product Development
o Globalization of Markets and Technology

#9
NA

#10
NA

#11
NA

#12

#13
o The Nature of Technological Innovation
o The Strategic Impact of Technological Change
o Emerging vs. Established Technologies
o Life Cycles and Technological Innovation
o Understanding Technology
o Technology Forecasting
o Assessing Strategic Potential
o What Does A Manager Need to Know About Technology
o Technology, Innovation and Strategic Management
o Managing Technological Innovation
o Technology and Strategy
o Strategic Choices in R + D
o Managing R + D

o Managing the Innovation Process
o Managing Emerging Technology
o Technical Venturing
o Technological Entrepeneurship and Strategy

#14
NA

#15
NA

#16
NA

#17
NA

#18
o A Different View of Managerial Tasks, Responsibilities and Practices
o Beyond Bureaucracy: The Adhocracy
o Government Influence on Innovation
o Lessons Learned in the Management of Large--scale Technology-driven Systems
o Technological Literacy
o Political savvy
o Creativity
o Strategic Vision
o A Brief Introduction to Design
o Organization Design
o The Human Factor
o Complexity, Catastrophe, and Quality

#19
NA

TEACHING TECHNOLOGY AND INNOVATION MANAGEMENT:
MBA and EMBA COURSES

IV. MATERIALS

A. Texts and/or Readings Books

#1 None

#2

1. James B. Quinn, Henry Mintzberg and Robert A. James, The Strategy Process: Concerns, Contexts and Cases, Englewood Cliffs, N.J.: Prentice-Hall, 1988

2. Robert A. Pitts and Charles C. Snow, Strategies for Competitive Success, New York: Wiley, 1988

#3

1. Thomas Peters and Robert Waterman, In Search of Excellence, Harper and Row, 1982.

2. Graham Allison, Essence of Decision, Little Brown, 1971.

3. Jay Galbraith and Robert Kazanjian, Strategy Implementation Structure, Systems, and Process, West, 1986

4. Robert Pitts and Charles Snow, Strategies for Competitive

Success, Wiley, 1986

5. Robert Miles, Coffin Nails and Corporate Strategy, Prentice Hall, 1982

6. Robert Reich, The Next American Frontier, Penguin, 1983

#4

1. Robert A. Burgelman and Modesto A. Maidique, Strategic Management of Technology and Innovation, Irwin, 1988.

#5

1. Blauner, R. Alienation and Freedom. Chicago: University of Chicago Press. 1964

2. Kidder, T. The Soul of a New Machine. New York: Avon. 1981

3. Marcus, L. Systems in Organizations. Marshfield, MA: Pitman. 1984

4. Turkle, S. The Second Self. New York: Simon and Schuster. 1984

5. Wilkerson, B. The Shopfloor Politics of New Technology. London: Heinemann. 1983.

#6

1. Dean & Goldhar, Management of Research and Innovation (North-Holland, 1980)

2. Tushman and Moore, Readings in the Management of Innovation (Pitman, 1982)

#7 None

#8 None

#9

1. Rosenburg, N. and L.E. Birdzell Jr.
How The West Grew Rich (Basic Books: New York, 1986)
Especially Chapter 8: "The Link Between Science and Wealth" - an excellent summary of the historic role of science and economic progress in the U.S.

2. United States, The President's Commission on Industrial Competitiveness Global Competition: The New Reality The Report of the President's Commission on Industrial Competitiveness, John A. young, Chairman (Government Printing Office: Washington, D.C., Jan 1985) Vol I and Vol II pp. 55-100.

3. U.S. Science and Engineering Base: A Synthesis of Concerns About Budget and Policy Development (G.A.O: Washington, D.C., March 25, 1987).

4. Tandau, Ralph and D. Jorgenson (Eds.), Technology and Economic Policy (Ballinges: Cambridge, MA, 1986).

5. Foster, R. Scott (Ed), The New Economic Role of American States (Oxford V. Press: N.Y., 1987).

6. Cohen, T. and John Wysman, Manufacturing Matters: The Myth of the Past-Industrial Economy (Basic Books: NY, 1987).

#10

1. Burgelman, R.A. and Maidique, M.A. Strategic Management of Technological and Innovation, Irwin, 1988.

#11 None

#12 None

#13

1. Managing Technology, Frederick Betz, Prentice-Hall Inc., 1987.

#14

1. Elwood S. Buffa, Meeting the Competitive Challenges: Manufacturing Strategy for U.S. Companies (Dow Jones-Irwin, 1984). (paper edition is available)

2. Richard J. Schonberger, Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity (The Free Press, 1982).

#15 Kamm, Judith B., An Integrative Approach to Managing Innovation. (Lexington, MA: Lexington Books, 1987).

#16

1. Donald V. Nightingale, Workplace Democracy, (University of Toronto Press, 1982).

#17 None

#18 None

#19 None

NUMBER OF COURSES USING TEXTS AND/OR READINGS BOOKS PRIMARILY: 10.

B. Looseleaf Cases

#1

"The Biotechnology Industry"
Bendix Autonation Group, "A,C,D"
Teradyne--The Foundry
Bi-Modal Corporation
Lex Service PLC, A,BC
General Foods Information Service Dept.
Texas Instruments Inc-Educational Products
Metaphor Computer Systems
Cray Research Inc.
The Microelectronics and Computer Technology Corp.

#2

The U.S. Bicycle Industry
Sony Corporation
I.B.M. (A) + (C)
The Continental Group, Inc.
Dennison Manufacturing
The Hewlett Packard Company
The Rose Company
Comparitive Planning Systems: Titton Industries and Texas Instruments
The Lordstown Fiasco

#3 None

#4 None

#5 None

#6

Biodel
Silicon Valley Specialists
Computer Devices
Appli
Concept Devices
Teradyne

#7 None

#8

Sierra Log Homes, Inc (A)
Trus Joist Corporation and Addendum
Medical Diagnostic Imaging
EMI and the CT Scanner (A) + (B)
Speer Industries, Inc. (A), (B), (C)
Note on the World Copier Industry in 1983
Canon, Inc. (B)
Reliance Electric Motor Division (A)
Ampex Corp; Product Matrix Engineering
Bendix Automation Group (A)-(D)
Cray Research, Inc.
Silicon Valley Specialists (A) + (B)
Renn Zaphiropoulos and Fred Henderson
Sof-Optics (B)
Corning Glass -- Z Glass Project
Note on Paper Making
Mead Corp. -- Abridged
Sarepta Paper Co. (C) -- Abridged
Armco Steel
General Electric Co.: Major Appliance Business Group (A) + (B)
Competitive Status of the U.S. Automotive Industry-1981
World Pharmaceutical Industry: Prospects for the 1980's
CIBA-GEIGY Pharmaceutical Division: Multinational Strategic Planning

#9 None

#10

Banc One and the Home Information Revolution (9-682-091)
EMI Medical, Inc. (A) (9-382-140)

#11

Gunfire at Sea
Pilkington Float Glass (A) (9-672-069)
Note on the Flat Glass Industry - 1955 (9-672-070)
Advent Corporation (C) (9-674-027)
Medical Diagnostic Imaging
Biodel, Inc (A) (8-684-001)
Ceramics Process Systems, Inc. (A) (9-687-030)
A Box of Cigars for Brad
Sun Microsystems, Inc. (A) + (B) (9-686-134) Rev 8/86

General Electric Lighting Business Group: The High Speed Horizontal Project
Texas Instruments Inc. -- Educational Products (9-683-001, Rev. 1984)

"Design Case History: Apple's Macintosh," IEEE Spectrum, Dec. 1984.

"Design Case History: The Commodore 64," IEEE Spectrum, March, 1985.

Everest Computer: The Development of the Super MOS Process (0-685-085, Rev. 2/86)

Honeywell Residential Division: New Product Development

Plus Development Corp. (A) + (B) (0-687-001)

Claire McCloud (9-680-030)

#12 None

#13

Technological Change in the Photographic Industry (A) + (B)
Timex Corp. (A) + (B)
Claire McCloud
EMI and the CT Scanner (B)
Silicon Valley Specialists
A Box of Cigars for Brad
FMC Corporation

#14 None

#15

Vermont Castings
Software Action Team
Braintree Hospital
Lex Service PLC A + B
Au Bon Pain -- The Partner/Manager Program

#16

Workers' Councils (9-481-103)
The Worker Participation Experience at Kootenay Forest

Products
Donnelly Mirrors 9-473-088
Magna International
Belhoney Mfg (A) + (B) 4-481-005,-006
General Motors and United Auto Workers (9-481-162)
CSP Foods

#17

Kramer Tool and Die

#18

McCulloch Oil Corp (9-677-067)
Clair McCloud (9-680-030)
Incremental Leadership (9-385-106)
Aerospace Systems (D) (9-474-164)
IBM Corporation: The Bubble-Memory Incident (180-042)
The ASP Project (A) (9-365-021)
Strike In Space (9-481-008)

#19 None

NUMBER OF COURSES USING CASES PRIMARILY: 9

C. Articles on Managing Innovation (Only those with full citation included. No book chapters or government reports included.)

#1

None used.

#2

Not fully cited.

#3

Joseph Bower, "Business Policy in the 1980's," Academy of Management Review, 1982, 7: 630-638.

Richard Vancil and Peter Lorange, "Strategic Planning in Diversified Companies," Harvard Business Review, January-February 1975.

Henry Mintzberg, "Patterns in Strategy Formation," Management Science, 1978, 24: 934-948.

James Brian Quinn, "Strategic Change: Logical Incrementalism," Sloan Management Review, Fall, 1978.

Robert Burgelman, "A Model of the Interaction of Strategic Behavior, Corporate Context, and the Concept of Strategy," Academy of Management Review, 1983, 8: 61-70.

Raymond Miles, Charles Snow, Alan Meyer, and Henry Coleman, "Organizational Strategy, Structure, and Process," Academy of Management Review, 1978, 3: 546-562.

Danny Miller, "Evolution and Revolution: A Quantum View of Structural Change in Organizations," Journal of Management Studies, 1982, 19: 131-151.

Raymond Miles and Charles Snow, "Organizations: New Concepts for New Forms," California Management Review, 1986, 28: 62-73.

John Child, "Organizational Structure, Environment, and Performance: The Role of Strategic Choice," Sociology, 1972, 6: 1-22.

Jay Bourgeois, "Strategic Management and Determinism,"

Academy of Management Review, 1984, 9: 586-596.

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Irving Bluestone, "Towards New Freedom at the Work Place", Employee Relations Law Journal, V. 2, N. 3, pp. 252-61.

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Business Week, May 16, 1983, "A Revolution in Work Rules", pp. 100-103, 106, 108, 110.

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E. von Hippel, A Customer-Active Paradigm for Industrial Product Idea Generation, Research Policy, 7(19780, 240-60.

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Robert C. Seamans, Jr., and Frederick I. Ordway, "The Apollo Tradition," Interdisciplinary Science Reviews, vol. 2, No. 4 (1977).

John M. Logsdon, "The Space Shuttle Program," Science (30 May 1986).

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Rosabeth Moss Kanter, "The Middle Managers as Innovator," Harvard Business Review (July-August 1982)

Henry Mintzberg, "Planning on the Left Side and Managing on the Right," Harvard Business Review (July-August 1976).

James Brian Quinn, "Technological Innovation, Entrepreneurship, and Strategy," Sloan Management Review, vol. 20, no. 3 (1979).

Robert H. Waterman and Thomas J. Peters, "Structure Is Not Organization," Business Horizons (June 1980).

Dennis Kneale, "Working at IBM", Wall Street Journal (7 April 1986).

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Urban, Glen L., Theresa Carter, Steven Gaskin, and Zofia Mucha. "Market Share Rewards to Pioneering Brands: An Empirical Analysis and Strategic Implications." Management Science 32, no. 6 (June 1986):645-59.

Edwin Mansfield, J. Rapoport et al., "Social and

Private Rates of Return From Industrial Innovations," Quarterly Journal of Economics, pp. 221-40.

Nelson, Richard R. "The Simple Economics of Basic Scientific Research." Journal of Political Economy 67, no. 3 (June 1959): 297-306.

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von Hippel, Eric. "Successful Industrial Products From Customer Ideas." Journal of Marketing 42, no. 1 (January 1978):39-49.

von Hippel, Eric. "Lead Users: A Source of Novel Product Concepts." Management Science 32, no. 7 (July 1986b):791-805.

Katz, Ralph and Allen, "Project Performance and the Locus of Influence in the R&D Matrix" Academy of Management Journal, March, 1985.

Number of Courses Using Articles:

D. Software - None indicated.

# APPENDIX "G"

Tufts University, Fletcher School of Law and Diplomacy

TUFTS UNIVERSITY
The Fletcher School
of Law and Diplomacy
Administered with the cooperation of Harvard University

TO: Andre Potworowski

COMPANY: IDRC

FAX: 613-238-7230

SENDER: Karin McMaster, Secretary to Prof. Simon

DATE SENT: 2/8/90

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# Seminar on International Technology Transfer

Business 235
Fall 1989

Prof. Denis Fred Simon
Office: Cabot 508
Hours: Wed. 1:30-4:30

Course Description:

This course examines the nature and scope of technology flows among countries, focusing on the "transfer and assimilation" issues within the context of the following issue areas: a)East-West relations and export controls; b)Third World development; c)international competition among the advanced industrial nations; and d)technology exchanges among developing nations. The course will pay principal attention to the role of the multinational firm as the primary purveyor of technology transfers, examining such issues as overseas R&D, forms of technology transfer, pricing of technology, leveraging technology for competitive advantage, etc. The experiences of several different countries will be highlighted as a means to identify sources of past problems as well as the keys to successful utilization of foreign technology.

Readings:

There are five required (*) and one recommended (R) texts for the course:

* a)John Dunning, Multinationals, Technology and Competitiveness, Unwin Hyman, 1988

* b)Bruce Guile, ed., Technology and Global Industry, National Academy Press, 1987

* c)Edwin Mansfield, et.al., Technology Transfer, Productivity and Economic Policy, Norton, 1982

* d)Daniel Roman and Joseph Puett, International Business and Technological Innovation, North-Holland, 1983

* e)Denis Simon & Detlef Rehn, Technological Innovation in China: The Case of the Shanghai Electronics Industry, Ballinger, 1988

R f)Ralph Landau & N. Rosenberg, eds., The Positive Sum Strategy: Harnessing Technology for Economic Growth, National Academy Press, 1987

NOTE: There are also a series of required readings on reserve in the Fletcher library. These readings are designed to provide students with the most informative and relevant literature related to the issues covered in the course. It is suggested that you use the required texts as the core of your reading,

supplementing each section with selected articles identified in the syllabus.

Course Requirements:

Students will be graded according to their performance with respect to 1)a midterm exam (30%), 2)an indepth research paper (50%), and 3)class participation (at least 20%).

1)The midterm will be a take-home, essay-type examination that will test your knowledge and understanding of the lectures and readings contained in the first 2/3 of the course. The exam will be about 10 double-space, typed pages. It will be distributed on November 13, 1989 and will be due back to the instructor by 12 noon on November 17, 1989.

2)The research paper is designed to provide each student with an opportunity to explore, in an in-depth fashion, a topic of his/her specific interest. The paper is to be typed (35-40 double-spaced pages in length). It should reflect the use of both primary and secondary source materials. A list of possible topics will be provided by the instructor though students are free to select their own topics after consultation with the instructor. Papers are due December 11, 1989. Late papers will not be accepted.

3)Class participation will be evaluated as a means to encourage students to attend class and participate in class discussions. Since this is a seminar, your willingness to share your ideas, experiences, and questions with your classmates (and your instructor) will only help make the class more interesting and productive for everyone.

September 11 — Introduction: What is Technology? What Role Does it Play in Development & Competitiveness?

Roman & Puett, pp.1-16, 47-54
Mansfield, pp.1-27
Guile, pp.1-15
Dunning, pp.9-28
Devendra Sahal, Patterns of Technological Innovation, Addison Wesley, 1981, pp.1-40
Nathan Rosenberg, Perspectives on Technology, Cambridge U Press, 1976, pp.61-84
(R)Landau/Rosenberg, pp.17-32

September 18 — Theoretical Frameworks for Examining Technology Transfer

Roman & Puett, pp. 17-46, 107-136, 159-182
Guile, pp.96-118 & 246-256
Dunning, pp.29-46
E. Mansfield, "Inter. Technology Transfer: Forms, Resource Requirements & Policies," American Economic Review, Vol 65, May 1975
David Teece, "The Market for Know-How & the Efficient Inter. Transfer of Technology," The Annals of American Academy of Political and Social Science, Nov 1981, pp.81-96
Edward Graham, "Tech Innovation & the Dynamics of the US Comparative Advantage in Inter Trade," C.T. Hill & J. Utterback, Technological Innovation for a Dynamic Economy, Pergamon Press, 1979, pp.118-152
Kaz Poznanski, "International Diffusion of Steel Technologies," Technological Forecasting and Social Change, " Vol 23, 1983, pp.305-323

September 25 — Motivations & Strategies of Technology Suppliers and Recipients

Roman/Puett, pp.201-222, 223-244
Mansfield, pp.27-49
Guile, pp.65-95
Dunning, pp.144-171
Anita Benvignati, "International Technology Transfer Patterns in a Traditional Industry," Journal of Inter Business Studies, Winter 83
Allen Jedlicka & A. Rubenstein, "Acquiring & Using Technological Information: Barriers Perceived by Colombian Industrialists," in James Street & D.D. James, Technological Progress in Latin America, Westview, 1979 pp.111-120

Loretta G. Fairchild, "Performance & Technology of US & National Firms in Mexico," in Street and James, pp.129-148

October 2 — The Role of the Firm in Developing & Diffusing Technology

Roman/Puett, pp.55-72, 249-278
William Abernathy & J. Utterback, "Patterns of Industrial Innovation," Technology Review, June/July 1978
Guile, pp.16-49
Dunning, pp.103-122
E. Mansfield, Production & Application of New Industrial Technology, Norton, 1977, Chap 1
Denis Simon, "Rethinking R&D," China Business Review, July/Aug 1983
(R)Landau/Rosenberg, pp.275-332

October 9 — Columbus Day

October 16 — The Interface Between National Policy & Firm Behavior vis-a-vis Technology Transfer Issues

Roman/Puett, pp.75-106
Guile, pp.191-245
Mansfield, pp.173-207
Dunning, pp.69-102
K.H. Oppenkinder, "The Role of Business & Government in the Promotion of Innovation and Transfer of Technology," C.T Saunders, Industrial Policies & Technology Transfers Between East & West, Springer 1977, pp.243-68
A. Nussabaumber, "Financing the Generation of New Science & Technology," B.R. Williams, ed., Science & Technology in Economic Growth, Wiley, 1973, pp.169-198
"The Great Debates: Technology & National Policy," High Technology, October 1984
K.N. Rao & C. Weiss, "Government Promotion of Industrial Innovation," in C., Weiss and N. Jequier, Technology Finance & Development, Lexington, 1984.
Denis Simon, "S&T Reforms," China Business Review, March/April 1985
H. Riesenhuber, "Orientation & Perspectives of Germany's Research & Technology Policy," IJTM, Vol. 1, 3/4, 1986
E. Blakely, "Innovation as National Industrial Policy," IJTM, Vol 2, #5/6, 1987

October 23 — The Infrastructure for Technology Absorption

Roman/Puett, pp.279-320
Dunning, pp.172-202
T. Allen et.al., "The International Technological Gatekeeper," Technology Review, May 1971
D.F. Koeppe, "Measuring Effectiveness in Technology Transfer," Sherman Gee, Technology Transfer in Industrial Countries, Sijthoff & Noordhoff, 1979, pp.273-289
Simon Teitel, "The Skills & Information Reqts of Industrial Technologies," Trade, Stability, Technology & Equity in Latin America, 1982
Denis Simon, "China's Capacity to Assimilate Foreign Technology," US Congress, China Under the Four Modernizations, Joint Economic Committee, August 1982
Julian Cooper, "Western Technology & Soviet Economic Power," in M. Shaffer, Technology Transfer & E-W Relations, St. Martins, 1985
"Union Carbide Fights for Its Life," Business Week, December 24, 1984

October 30 — The Case of Japan: An Adaptive Strategy

T. Allen et.al, "Government Influence on the Process of Innovation in Europe & Japan," Research Policy, April 1978, pp.124-149
R. Caves & M. Vekusa, "Imported Technology and Industrial Progress," Industrial Organization in Japan, Brookings, 1976, pp.124-40
Masaru Saito, "Diffusion Mechanism of Technology," OECD, Transfer of Technology for Small Industries, Paris, 1973, pp.161-176
Merton Peck & A. Goto, "Technology & Economic Growth: The Case of Japan," Research Policy, Volume 10, 1981, pp.222-243
M. Anchorodoguy, "Mastering the Market: Japanese Government Targeting of the Computer Industry," International Organization, Summer 1988
(R)Landau/Rosenberg, pp.541-606

November 6 — Instruments of Technology Transfer

Roman/Puett, pp.321-380
Mansfield, pp.65-86
Dunning, pp.47-68 & 123-143

Farok Contractor, "The Composition of Licensing Fees & Arrangements..," Journal of International Business Studies, Winter 1980
Edith Penrose, "International Patenting and the LDCs," The Economic Journal, Sept 1973
Lynn K. Mytelka, "Licensing & Technology Dependence in the Andean Group," World Development, Vol 6, 1978, pp.447-459
"PC Piracy Growing by Leaps and Boundaries," PC Magazine, January 23, 1984
Stobaugh and Wells, Technology Crossing Borders, pp.157-202 (Stobaugh; Telesio)

CASES: Assorted Cases for Classroom Discussion

November 13 MIDTERM EXAMINATION

November 13 Foreign Investment & Technology Transfer: A Closer Look

Roman/Puett, pp.411-454
Stobaugh and Wells, pp.21-46 & 203-240 (Yeoman; Rafh)
Jack Baranson, "Negotiating w/MNCs for Technology Sharing Agreements," V.L. Urquidi, Science & Technology in Development Planning, Pergamon Press, 1979, pp.173-189
Kiyoshi Kojima, "Transfer of Technology to Developing Countries: Japanese vs American Types," Hitotsubashi Journal of Economics, February 1979, pp.1-14
C.V. Vaitsos, "Government Policies for Bargaining with TNCs in the Acquisition of Technology," Mobilizing Technology for World Development, pp.99-106
Larry Westphal, et.al., "Sources of Technological Capability in South Korea," in Martin Fransman, Technological Capability in the Third World, St. Martins, 1986
Amir Khan, "Appropriate Technologies: Do We Transfer, Adapt or Develop," E. Edwards, Employment in Developing Nations, ILO
Dunning, pp.203-232

November 20 — Third World Perspective: Technology Transfer and the International Division of Labor

Roman/Puett, pp.471-490
Sanjaya Lall, "Technological Learning in the Third World," Frances Stewart, The Economics of New Technology in Developing Countries, Frances Pinter, 1982, pp.158-179
J.S. Rao, "Science & Technology in India," Science, July 12, 1985
Y. Yuthavong, et.al., "Key Problems in S&T in Thailand," Science, March 1, 1985
H.S. Choi, "Adapting Technology: The Korean Case," E. Rabinowitch & V. Rabinowitch, eds., Views of Science, Technology & Development, Pergamon, 1975, pp.17-33
Francisco Sagasti, "Underdevelopment, Science and Technology," Science Studies, #3, 1973
Martin Fransman, "Some Hypotheses Regarding Indigenous Technological Capability: Machine Production in Hong Kong," in M. Fransman, Technological Capability in the Third World, St. Martins Press, 1985

November 27 — Technology Transfer and East-West Relations

National Academy of Sciences, Balancing the National Interest, Washington, D.C. 1987 (Read selectively)
Marshall Goldman, "Why Not Sell Technology to the Russians," Technology Review, March 1984
J. Fred Bucy, "Technology Transfer & E-W Trade: A Reappraisal," International Security, Winter 1980/81
Gary Hufbauer & J Schott, "Economic Sanctions: An Often Used & Occasionally Effective Tool of Foreign Policy," Michael Czinkota, Export Controls, Praeger 1985
Dept. of Defense, "Soviet Acquisition of Western Technology," Washington, D.C., 1982

December 4 — Foreign Technology and China's Modernization

Denis Simon & Detlef Rehn, Technological Innovation in China: The Case of the Shanghai Electronics Industry, Ballinger, 1988 (Entire)
Denis Simon, "Technology for China: Too Much Too Fast," Technology Review, October 1984
"How China Buys Technology," China Business Review, May/June 1987, pp.34, 40-55

Roy Grow, "Transferring Foreign Technology: Steps in the Chinese Decision Process," in Denis Simon & Merle Goldman, eds., Science and Technology in Post-Mao China, Harvard, 1989
Richard Conroy, "Domestic Sources of New Technology for the Chinese Industrial Enterprise," OECD, Unpublished, 1987
Denis Simon, "The Challenge of Modernizing Industrial Technology in China," Asian Survey, April 1986

December 11 — The US-Japan-Western Europe Triangle: Overseas R&D and Technology Transfer

Dunning, pp.233-250 & 251-263
Stobaugh and Wells, pp.241-264 (Ronstadt)
W. Dekker, "Prospects for Collaboration & A Common Industrial Policy in Europe," IJTM, Vol. 1, #3/4, 1986
Gary Hewitt, "R&D Performed Abroad by US MNCs," Kyklos, Vol 33, 1980, pp.308-327
Mansfield, pp.87-107 & 208-234
Rushing/Brown, pp.71-88 (France)
"Japan is Buying Its Way into US University Labs," Business Week, September 24, 1984
"Japan Focuses on Basic Research to Close Creativity Gap," Business Week, Feb 25, 1985
R.V. Maldren, "Worldwide Telecommunications Technology Transfer," IJTM, Vol 2, #5/6, 1987
Sherman Gee, Technology Transfer, Innovation and Competitiveness, Wiley, 1981, Chaps 4 & 5
Jack Baranson, Robots in Manufacturing: Key to International Competitiveness, Lomond, 1983
(R)Landau/Rosenberg, pp.479-516 & 527-534

Politics 250 Spring 1990
Professor Denis Fred Simon Mondays 1:30-3:20 pm

Seminar in Comparative Technology Policy & Management

This seminar provides a detailed overview of the formulation and implementation of technology policy at two levels: the firm and the nation-state. Beginning with an analysis of the multiple dimensions of the innovation process, the course examines the different approaches adopted by various countries to enhance the performance of indigenous institutions regarding technology generation, commercialization, utilization, and adaptation. Also included are discussions of technology management and innovation in different industries such as computers, electronics, nuclear power, etc. As a course that is comparative in nature, an effort will be made to compare and contrast the different strategies adopted by various countries as they attempt to deal with the complex challenges associated with the promotion of science, economic competitiveness, and national security.

Required Texts:

Emanuel Adler, The Power of Ideology: The Quest for Technological Autonomy in Argentina and Brazil (UC Press, 1987)

Rod Coombs, et.al., Economics and Technological Change (Rowman & Littlefield, 1987)

Kenneth Flamm, Creating the Computer (Brookings Press, 1988)

Antonio Furino, ed., Cooperation and Competition in the Global Economy (Ballinger, 1988)

Hugh Patrick, ed., Japan's High Technology Industries (University of Washington Press, 1986)

Denis Fred Simon, Technological Innovation in China: The Case of the Shanghai Electronics Industry (Ballinger, 1988)

Recommended Text(s):

William Rushing, ed., National Policies for High Technology Industries (Westview Press, 1986)

Readings:

There are also a series of journal and book articles on reserve in the Fletcher library that are an integral part of the required reading assignments.

Course Requirements:

A take-home essay-type midterm based on the readings & lectures (30%) [approximately 10 double-spaced, typed pages)

A seminar presentation on your research topic (20%)

A research paper using primary reference materials (50%) [approximately 35-40 double-spaced typed pages]

Reading Requirements:

You have been asked to read a rather hefty amount of material for this seminar. Frankly speaking, this frightens some people. Obviously, some of you will read more than others. In providing you with a broad array of readings from leading journals and books in the field, I am only suggesting that you read as much as you believe is feasible and necessary. At the same time, however, I also expect you come to come to class prepared to discuss the assigned materials in a critical fashion. The more prepared you are for each seminar meeting, the richer the discussion and the more interesting our seminar meetings will be. Remember, as a seminar participant, each one of you (as well as myself) is very much responsible for the success of the class. [Read selectivity, but read as much as possible.]

Instructor's Policies:

1. All papers must be doube-spaced and typed as well as properly footnoted.

2. Late papers will not be accepted. This is a firm policy!

3. If you are using the research paper in this course for a 1/2 MALD or MALD, it is still your obligation to hand me a completed paper by the end of the Spring semester. Writing some type of MALD for this course is no excuse for handing in a late paper.

4. Access to a computer or typewriter for completing the midterm or the research paper is your problem. I will not accept late papers because you cannot get access to a computer or typewriter. My suggestion is that yo start early to beat the end of semester rush!

5. I will hold office hours on Wednesday afternoons from 1:30-5:00 pm. There will be a sign-up sheet outside my door. Come early because the list gets filled very quickly. If you must see me outside these hours, I am available. Contact my secretary Karin McMaster at x2003.

January 11 — Introduction

January 15 — University Holiday

January 22 — The Essence of the Innovation Process

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# APPENDIX "H"

Research Management Centre, University of Los Banos in the Philippines -- course outlines

Type of Activity: SEMINAR-WORKSHOP

Prototype Title : **TECHNOLOGY ASSESSMENT AND PROMOTION**

Theme: : MOVING RESEARCH OUTPUTS THAT MAKE A DIFFERENCE TO END-USERS AND SOCIETY

Participants :

Date : (FOUR DAYS, LIVE-IN)

Venue :

## RATIONALE

In the transition from subsistence to modern economy, science and technology takes an increasing role. Science and technology by themselves are significant. In that state they are simply fixtures like stones and sands. When placed in minds, hearts and hands of men they become tolls to build structures, to solve problems, to create objects and serve as means to man's goal attainment. From simply surviving as part of natures world, with enhanced mental and physical capabilities, man becomes a co-creator of nature. Not simply an object, but a subject, an active co-builder of his own world and future.

For an accelerated economic recovery of our country, popular participation in terms of investment and employment is imperative. Investment by big as well as small investors in various sectors will trigger productivity, higher income and more employment.

A populace approach in investment and employment should be encouraged for a more democratic and stable economic development. In this regard, technological innovation and information should access to them. With easy access to them, more people are given the opportunity to invest or use technological innovations and information.

Research and Development and Technology-Utilization institution are enjoined to be aggressive, conscientious, and act jointly towards the goal of accelerated diffusion and adoption of technological developments for greater socioeconomic impact on the people.

Institutions like UPLB are committed to advancing aggressively results of research to the production point. When research information is practiced and internalized into a production system of a farm, a factory, a firm, a community, or an organization, research becomes a tool priming social change and development.

The carrying out of this research-development mandate requires a high degree of skills and professionalism and the proper design of organization and management system.

**PURPOSE**

The intent of the seminar-workshop is to internalize organizational commitment, capability to develop internal system of technology assessment and evaluation and advance research results so that they are known and finally adopted by various end-users.

**OUTPUTS**

The following outputs are expected from the participants in this course:

1. Institution system of assessing technology at various R-D stages. This will include priority setting, identification of mature technologies and institutional strategy for advancing and promoting research outputs.

2. Case outputs (oral and written reports)

**SYLLABUS**

I. Setting the Right Perspective

Sub-theme: Research institution as a development entrepreneur

* Technology and Social Change
* Parameters of Performance of Research Institutions (How to keep score)
* What is Research and Development
* Research-Development Continuum (Research Strategies)

II. Technology Assessment: From Pre-Project to Impact on End-Users

Sub-theme: Institutionalizing a system or methodology for technology assessment

* Project Identification Process
* Prioritization of Projects
* A Framework for Technology Assessment

* Components of Technology Assessment (technical aspect, financial aspect, economic aspect and environmental aspect, social aspect, institutional aspect and political aspect)
* The Case of SEARCA's Research Utilization Project

III. Research Utilization Strategies

Sub-theme: "Before practice, let's know the theory and principles first"

* Relevant Social Processes:
  - Research Utilization
  - Communication
  - Technology Transfer
  - Diffusion of Innovation
  - Adoption Process
* Research-Extension Linkage Management
* Organizational Modes for Promoting Results of Research
* Case Studies on Technology Transfer in Government, Business, Industry (Agriculture, Engineering, Medicine, Education, etc.)

IV. Making a Promotional / Communication Campaign

Sub-theme: Mobilizing research, extension and other systems for mass adoption of research outputs

* Relevant Knowledge Foundation in Social Behaviour
* Principles in Social Marketing
* Lessons from Advertising
* Organizational and Management Implications
* Case Studies in Industry, Government and NGO
* Designing a Communication Campaign

A Project on a System For Technology Development and Promotion

Theme: Institutionalizing Technology Evaluation and Promotion Capability at UPLB

A Proposal
Proponent: Business Affairs Office and Research Management Center

Rationale

The expectations from government, business and industry and producers for the Philippine Science and Technology sector to catalyze productivity and industrialization has been high. Except for a few instances like, varieties developed, tilapia and bangus, beverages, some farm machineries, and horticultural practices or tissue propagation culture of ornamental plants, there are not that many outputs of research that have penetrated the mass market or have made substantial changes and progress in the countryside.

In the recently released report of the external review of the University of the Philippines (UPLB) programs and overall state, the review concluded that UPLB is losing its influence in agriculture, natural resources, agrarian, education and science sector. While UPLB's faculty as individuals are in great demand outside and even in the international consultancy market, as an institution it has not taken the lead to create a dynamic rural sector.

The much written about claim that UPLB is accounted for close to 80% of research outputs in agriculture, forestry and related disciplines and that these research outputs are only gathering dust in the shelves, might be true. However, they will continue to gather dust in the shelves not because of lack of interest by potential end-users. The reason is that these research outputs have not been subjected to practical, economic, and financial and environmental tests. Because of this the researchers themselves lack the confidence to release their own work in the market place. They are contented reporting their work to their peers who themselves don't ask questions beyond research procedure, degrees of freedom, experimental error and statistical significance.

In a few cases that there is a real promising technology, the researcher seem bewildered what to do next or fail to see the real developmental value of his work.

One other common problem why UPLB has not been always mention in the market place as the source of useful technology

relates to the choice of subject matter or problem of research. If the outputs of research do not answer a production or practical problem of producers and businessmen or if these people do not see a business prospect in these technologies, the response will naturally be passive or indifferent.

A related problem is on the purpose of the researcher in doing the research. A confirmed hypothesis, a reliable research instrument or a generalizable principle are not of interest to a practical producer or a hardnose businessman. But these are what motivate most university researchers.

## Goal

The goal of this proposal is for each UPLB institute, center and department to produce research information and technologies that promote productivity, high income, positive socio-economic impact, environmental quality and sustainable physical resources. In the process or as a consequence of this research outputs, the state-of-the Art of the relevant disciplines will be enriched.

When UPLB shall have developed the methology or approach for technology development and promotion, it shall share the same to other research systems in the country.

## Purpose

As means to achieve the above goal this proposal will help research institutes, centers and departments to develop their own internal tool, system and capability to evaluate research proposals and intiatives, monitor progress of research and to identify mature information and technology. Beyond this the UPLB units must learn how to promote, communicate and extend research outputs to their various publics.

The target date to achieve this is two years. Beyond this period UPLB will share its experience with other research systems such as State Colleges and Universities (SCUs), the agencies of Department of Science and Technology (DOST), Department of Agriculture and Department of Environment and Natural Resources (DENR).

## Objective

More specifically, the following outputs are envisioned here:

1. An internal rapid technology evaluation system for institutes, centers, and departments;

2. Designated individuals who will be trained on the concept, system and tools of technology evaluation and promotion and one will serve later as the

coordinator for technology evaluation and promotion;

3. Manual and other teaching materials on technology evaluation and promotion particularly in determining economic and financial profitability and business viability and in effective research utilization; and

4. A team of trainors on technology evaluation and promotion.

Organization and Management and Strategy of Implementation

1.0 A UPLB project shall be formed to manage the activities related to this plan. The BAO and RMC shall take the lead in implementing this project. They will tap university experts and specialists to help draw up the technical design of the system. The ODR, ODE and DFI will serve as members of the advisory board of this project.

2.0 The first major task of the project is to design the system of technology evaluation and promotion. This will be undertaken with the help of specialists in technology assessment, economics, agribusiness, marketing, environment, sociology, cooperative and communication.

3.0 The second major activity is to validate the design of the system with Directors and Heads of Institutes, Centers, and Departments. This will be done in a seminar-workshop lasting for half a day to one full day.

4.0 After revision of the technical design and procedure a training team will be formed to design the course and development the corresponding materials.

5.0 Two persons will be designated in each institute, center and department to serve as technology evaluation and promotion staff, one of them serving as coordinator and to participate in the training course to be called for the purpose.

6.0 A training course will be organized so that the participants will have a hands-on experience with the concept, system and tools of technology evaluation and promotion.

7.0 As part of the training, the participants will be required to meet with their units to develop their own internal system.

8.0 There will be a periodic meeting and common activities among the TEP coordinators to share with one another

the progress of their work, problems encountered, insights learned and prototypes developed.

9.0 An extension and communication activities with other research institutions in the country will be undertaken as soon as the system shall have been thoroughly tested.

Funding

Initially, no funding is required except money for some supplies and a gasoline which will be controlled by BAO.

Where funding is required are in:
1. Training
2. Training materials including manual and case studies.
3. Secretariat (Coordination)

4. Extension activities

## The Basic Concepts: University Technology Development and Promotion

Research in the state university has two general purposes. One is to increase the stock of knowledge and the other is to produce scientific knowledge and technologies that can catalyze productivity, economic activities and social change. Even if these two efforts are distinct, they are interrelated and mutually enriching.

This concept is confined to the developmental type of research at the university.

In the transition from subsistence to modern industrial economy, science and technology takes an increasing role. By definition technology has two components - the tool or devise and the user. Science and the devise by themselves are insignificant. In that state they are simply fixtures like stones and sands. When placed in minds, hearts and hands of users they become tools to build structures, to solve problems, to create objects and serve as means to man's goal attainment. From simply surviving as part of natures world, with enhanced mental and physical capabilities, man becomes a co-creator of nature. Not simply an object, but a subject, an active co-builder of his own world and future.

For an accelerated economic recovery of our country, popular participation in terms of investment and employment is imperative. Investment by big as well as small investors in various sectors will trigger productivity, higher income and more employment.

A populace approach in investment and employment should be encouraged for a more democratic and stable economic development. In this regard, technological innovation and information should be popularized and agresively disseminated to increase mass access to them. With easy access to them, more people are given the opportunity to invest or use technological innovations and information.

The problem why science has not primed social change and development in the Philippines can be analyzed from both the supply and demand ends. From the supply end, the outputs of research seems not to fit existing demand. The motivation for doing research is researcher-biased. The research problem is defined from the interest and perspective of science and the scientist rather than to solve potential end-users problems or promote their interest. The standard of performance and accountability is fixed by the scientific community which favors scientism rather than application or utilization by end-users.

From the demand end, there is a lack of organization to effectively articulate demands. The producers perceive scientists as ivory towerish, aloof and elitist.

Since we are from the supply end of the spectrum, this paper would like to point out how we can improve our part of the total problem.

First, the university should try to influence the bahavior of researchers rather than allow them to pursue only individual interest in the guise of academic freedom. This can be achieved by introducing an organization and management system that rewards problem-solving, technology oriented, demand-responsive or market-oriented research.

A technology development system must be devised and communicated throughout the university and that each unit must designate a lead person for this. The technology development system must include - project identification and selection, monitoring and evaluation and decision system on mature technologies. Only proposals in the units that pass their own internal system of rationalization (technical, economic, financial, social, political, institutional, and environmental) will be encouraged and supported. This system will favor end-user oriented , problem-solving and livelihood or income generation research.

Outputs of research that have not been verified , validated and subjected to end-user reality testing and those that do not pass financial, economic, environmental standards will not be released by the institution.

While entrepreneurship by the researchers is essential for effective promotion and should be encouraged, the decision on whether the work is already mature should be collective. Also,

the research unit should not leave the researcher alone to promote his work. This effort should be the responsibility of the institution.

There are studies in technology development and utilization the result of which should guide UPLB and its units in formulating guidelines and policies. One conclusion from these studies is that it is easier to sell or market a product for which there is an existing demand. Further, creating a new demand for a product through advertisement and campaign is usually very expensive, and takes longer time.

# The Research System and Research Utilization: How to Reach the End-Users

Rogelio V. Cuyno

## Definition and Basic Concepts

Research Utilization, our present subject, has many parallel terms.

Samples of these terms are: research-extension linkage, research applied communication, technology transfer, outreach, information services, science communication, etc.

We prefer to use research utilization to emphasize that there are many kinds of users of research results, such as: fellow researchers, research managers/administrators, policy makers, politicians, industry people and finally, the producers.

We can define research utilization in terms of its final test (as the saying goes, "The test of the pudding is in the eating"), which is, when the research result becomes integrated into the production process and behavior of the end-user. The crucial step in the long process is utilization. The end-user is, therefore, the dominant actor and decision-maker in the long series of decision-making situations.

The practical implication in this end-user-oriented definition is the need for the source of communication (in this case the research system) to try to know and understand the communication and decision-making behavior of the end-user. Correspondingly, the source has to fit the communication-extension strategy to this characteristic of the end-user.

The total process of research utilization takes a number of steps which we shall briefly discuss here:

1. **Technological Assessment.** It occurs when the research system identifies which of the research outputs it has produced are mature. The criteria for assessment include technical

soundness, economic attractiveness (considering costs and returns), presence of market for the product and its marketability and social benefit (to the needy and the majority).

2. **Promotion.** The research system uses communication and extension media and other strategies to disseminate research information to the intended audiences. The aim is to create awareness, develop interest and bring about understanding.

3. **Attention-Evaluation.** This takes place in the mind of the end-user using his own criteria in initially judging the attractiveness of the information. The problem for the research system here is that its criteria for desirability of the information might be different from those of the end-user. Thus the end-user might reject a technology outright because it does not suit his/her present needs and situation although, in the researcher's judgement, the technology is a winner.

4. **Transformation.** This is technically an extension of the previous step (attention-evaluation). Here the end-user, after deciding to accommodate the incoming information, continues to figure out the merits and demerits of the information, spending more time in evaluation and using the same criteria as in step 3.

5. **Acceptance.** It comes after the information survives the tests that it has been subjected to by the end-user. By accepting the technology, the end-user has committed himself/herself to possess it in due time, as if there is a moral contract or agreement between the end-user and the technology.

6. **Practice.** In the acceptance stage the end-user might momentarily delay pulling the trigger of final action. In the practice stage the trigger has been pulled. There is a behavior change taking place and the end-user has already possessed the technology by spending a certain amount of resources on it (time, money, effort, material, facilities, etc.). Here the end-user starts to put the technology into use.

7. **Internalization or Continuance.** After putting the technology into practice and after being satisfied with the result, the end-user decides to continue using the technology until such time when the situation changes -- when the particular technology will be subjected to a review process.

Fig. 1 shows that before a particular technology reaches the final end-user, say, a farmer, the technology passes through many hands such as: other researchers, subject matter specialists, bankers, politicians, extensionists, etc. This explains why there is a long gap from technology development to utilization.

Fig. 2 presents one theoretical basis of this end-user-oriented process of research utilization. In the social science literature this is called the technology diffusion-adoption process. Such a theory might be faulted for lacking unversality in that, for certain technologies and under some situations, decision-makers may volt steps or would follow a different sequence in the steps. Nonetheless it has a sound logic.

The theory suggested that diffusion-adoption is a step-wise and cumulative process, moving from one stage to the next without by passing any state. The Awareness stage occurs when the receiver of information physically comes in contact with the information for the first time through any of the senses (hearing, seeing, smelling, tasting and touching) or their combination.

In the Knowledge stage, the receiver puts to memory the information received in the awareness stage. If asked for the information, the receiver is able to retrieve or recall it from memory.

In the Understanding stage, the information retained by the receiver is analyzed by the brain so it makes sense to the person. In other words, the receiver is able to relate the various bits of information with one another and figure out how the system works.

Commitment is the stage when the receiver is persuaded to accept the information based on knowledge and understanding of it. In this stage the receiver says, "I"ll go along with this and will definitely do something positive with it."

In the Adoption stage the receiver has finally made the decision to use the information as

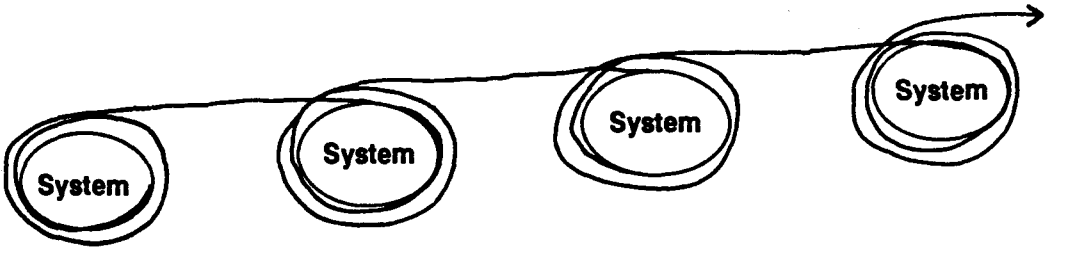



Figure 1. Series of transfer process of technologies

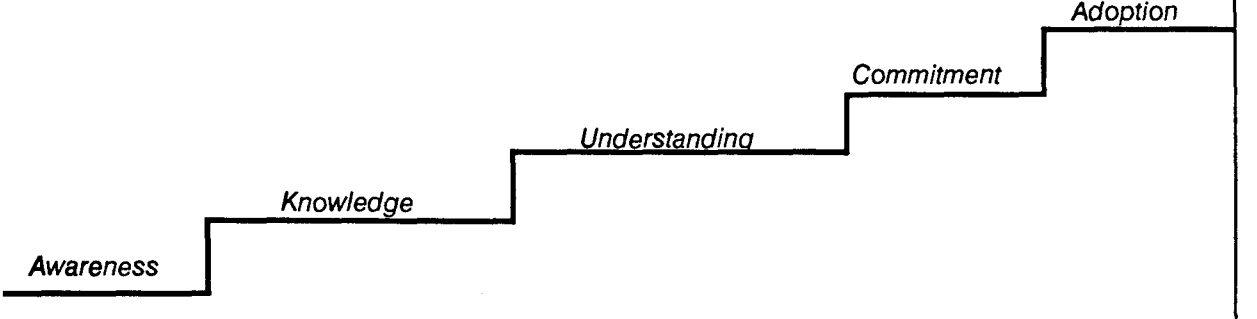



Figure 2. The technology diffusion-adoption process

manifested in behavior change. The person makes an investment in it in terms of time, money, effort, etc. This might involve totally replacing an old practice with the new one just adopted or combining the new with the old.

## Why Research Utilization is a Concern of the Research System

At present, most research systems -- whether international, local, government or non-government -- are imbued with some kind of a social mission. Their reason for being is rooted in a problem that affects a group of people who are either depressed, deprived, unreached or needy -- a problem for which a solution has to be found. There is an expectation that research and science will find the solution to the problem as they have done so many times in the past. In fact public or philantropic funds are allocated to these various research systems almost as an investment, expecting returns from it later in terms of knowledge or technology development that could be applied to the problem.

Recently, the institution of science and technology has been regarded as a prime over of social change and development. The work of Ruttan and Hayami on induced innovation points out that the introduction of a factor of technology into the agricultural sector will catalyze the system sending dynamic adjustments in the socio-economic structure which lead to social change and development.

Such terms of reference have put pressure on the research system to make it service- and public-oriented, thus raising the moral issue of public accountability. This means that the ultimate measure of performance of the research system has to be accounted for in terms of the benefits that the public derives from its outputs. Correspondingly, the research system starts to consider the public interest even at the planning stage and future assessments of the oputputs are made with the public good in mind.

Such public-orientedness creates greater public access to the domain of research and science. In an effort to be responsive to the problems and needs of the public, the research system finds it necessary to actively go out where the problems exist or to deliberately solicit inputs from its

public. All these work toward development of a philosophy of democratization of science and technology or an adherence to a two-way flow of communication and influence between the research system and the public.

**Democratization of Science and Technology**

Science and technology can be a great equalizer of opportunity in a country with an effective mechanism for extension and communication, coupled with government assistance in credit, marketing and farm to market roads.

Science and technology are getting to be increasingly important in the transition from dominance of nature to man-made world. Science and technology by themselves are insignificant. In that state, they are simply fixtures like stones and sand. When placed in the minds, hearts and hands of men they become tools to build structures, solve problems, create objects and serve as means to man's goal attainment. From simply surviving as part of natures world, with enhanced mental and physical capabilities, man becomes a co-creator of nature. He is not simply an object, but a subject, an active co-builder of his own world and future.

This linkage between knowledge and technology development and man as their ultimate users, must be clear in the minds of leaders of these institutions. We must not allow institutions to create artificial blinders, walls, barriers and distances between their work and end-users they profess to serve. Technology must be part of man. Technology must serve man, not the other way around.

History has proven that develoment in science and technology indeed can be a cutting edge and prime mover of social change. And development with opportunity for self-development given to more people -- not only on the basis of initial possession of power and wealth but on self-determination, will make possible greater practice of real democracy and social justice.

Unfortunately, the distribution of the benefits of science and technology in contemporary times has not trickled down and diffused to the masses in measures that are satisfactory to social

reformers. Some observers say that the real beneficiaries of present progress in agricultural science and technology are not farmers but the scientists themselves whose prestige and reputation for their development of technologies and scientific discoveries have been translated into material wealth ... the consultants whose marketability is based on technical expertise ... the international and local bank officials and employees who peddle and promote the adoption of new scientific discoveries. TLB Ulbricht echoes the lament of farmers in this statement. "I was hungry and you formed a committee to investigate my hunger; I was homeless and you filed a report on my plight; I was sick and you held a seminar on the situation of the underprivileged; you investigate all aspects of my plight and yet I am still hungry, homeless and sick."

**Why Research Utilization is Slow**

The external outflow process of research information and tehcnology -- from inital dissemination to adoption by end-users -- has been moving at a snail's pace. Such is the case despite of the pressure applied on the research system to produce miracles to alleviate poverty in the world and all the miseries that go with it. Many reasons contribute to the problem. First is the research-extension strategy that most research systems currently use for organizing their research in transferring their technology to other systems. Figure 3 illustrates this long and tedious step-by-step flow from research stations to regional trials to on-farm trials to piloting, to policy formulation to extension-communication campaign and finally to application or use of the output by the end-users. Such a process leads to a slow flow and transfer of messages due to the pressure of numerous transfer points and the apparent autonomy enjoyed by the variety of agencies involved in this process. The more actors involved in the whole chain of events, the longer it would take to complete the process. On top of that, the probability of message distortion increases as messages change many hands.

In some cases the product is technically, socially and economically sound, but the research-extension mechanism is not that good between the two systems. The problems of research and extension inter-organization jealousy, antagonism and mutual distrust, not to mention their internal problems

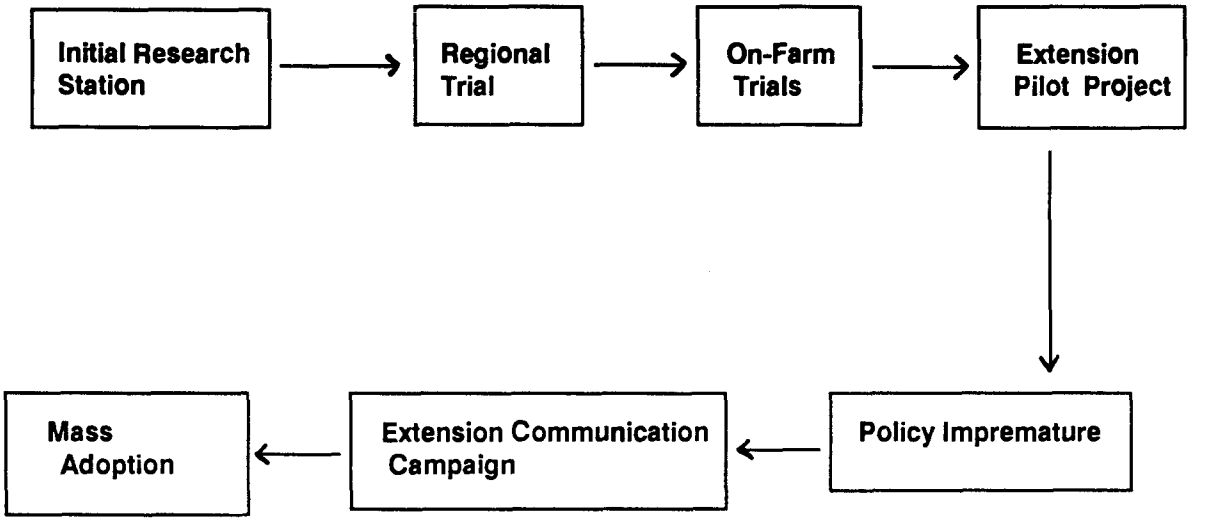



Figure 3. Chain of events in the traditional Agriculture Research Utilization Model

of lack of capacity and competencies, are counter-productive.

It is also widely known that the extension system in most developing countries is rather weak. This system is supposed to do the direct promotional and education work with the end-users. In general, this system is often faulted for the poor quality of its field workers and the inability of the organization to backstop and support field activities in terms of good supervision, technical assistance and funding. Naturally, with a weak extension organization and delivery mechanism, we would also expect slowing down in the transfer and utilization process of research-based extension messages.

A more serious institutional obstacle is the deficiency, absence of or lack of interrelationship among the critical support systems like credit facility, farm-to-market roads, market and marketing system, farm inputs, mass media communication, local government and localized research. No amount of product superiority and extension system efficiency and competence will make the end-user change his/her behavior in the absence of support systems.

Some of the these support systems function to actually block or thwart the entry of new technologies to protect certain vested economic, political social or religious interests. For instance, a dealer of seeds or chemicals would try to obstruct or throw off-course the entry of a new product which competes with what he is trying to sell.

## Typologies and Modes of Action of Research Utilization from the Viewpoint of Research System

In this presentation we are approaching the subject of research utilization, sometimes referred to as research-extension linkage, from the viewpoint of the research system. That is, research utilization is taken as an integral function of the research system and that it is incumbent on this system to create mechanisms for disseminating its research results until they reach the ultimate end-users.

There are at least seven typologies and modes of action that research systems have taken with respect to research utilization. They are:

1. **Research without extension/communication.** In this set-up research is the only thing that matters and extension/communication to producers is not regarded as a mandate. Centers of academic excellence doing very basic and fundamental researches in highly industrialized countries would tend to take this particular mode.

2. **Information Dissemination.** Some research institutions believe that publishing in scientific journals, writing books and sending popular articles to the mass media are sufficient to meet their obligations to extend and communicate their work.

3. **Technology Transfer Systems.** This mode takes the path of a two-way step flow assumption of technology diffusion. Once scientific information, knowledge and technologies are transferred to some intermediaries like extension systems, mass media, politicians, private industry and the like, there will be a multiplication effect and widespread distribution/circulation of technologies and finally mass adoption.

4. **Interactive Mode Among Researchers-Intermediaries-End-users.** Here, there is collaboration and joint action among the researchers, extension workers and the potential end-users from the initial conception of the research up to completion. The intermediaries need not be government extneion workers, they can be religious leaders or civic leaders. The end-users need not be the farmers, they can be the shop operators or farm machinery fabricators or food processing entrepreneurs.

5. **Contribution Mode.** Here the research institution tries to find out what the existing government and private development programs are. Then it selects what relevant information, knowledge and technologies it has which can contribute to the success of the development program. In this way it is able to positively contribute to the success of others using its own products.

6. **Clinic.** Just like in a clinic set-up, the research institution here opens its doors to walk-in clients for consultation, advice and shopping of ideas and products. The research institution may put up a display, demonstration area, a sales counter for publications, seeds and other materials or it may organize a lecture/seminar and open house for the public.

7. **Research with Extension.** This is like a corporate industry model wherein extension, promotion, marketing and advertising are integral parts of the research and manufacturing functions of the organization. In a way, there are "captive" end-users of the result of research -- the distributors or regular customers of the organization. This is true in some parastatals or in corporately managed government or private industries. In cotton, tobacco, coffee or cocoa corporate farms, the research department passes on to the extension department research findings which are then promoted or incorporated into the production system of the producers.

## How the Research System May Operationalize Research Utilization

The research system may operationalize its research utilization commitment through a strategy that might include the following:

1. **A Unit for Communication or Extension.** All too often in an organization, things are just not done well or not on a regular basis because no one is responsible for doing them. This happens to the extension-communication function in a research institution. Sure, the subject is on the agenda in staff meetings. Some money might even be allocated to it. But no one is assigned full-time, with a staff to develop the program and oversee the activities. If at all, the responsibility is considered add-on either to an underutilized technical staff or to somebody who has an inclination for P.R. work or to somebody who writes well, as if extension-communication is purely writing.

   Extension-communication is indeed a crucial function for the research system, particularly at this time when society expects much from it

and when external support to it is determined by its performance based on social relevance and positive impact on productivity and income. For this, research systems are given a mandate of extension, which is usually called training, technology transfer, public information or communication. But much of the attention given to this mandate is only token or lip service. A management decision is needed to reflect this mandate in the organization's structure and budget.

Once the structure for the extension function is defined and a share in the core budget of the institution determined, the institution must next recruit staff with the professional skills and proper outlook.

The functions of such a unit might include the following:

- o Organize and manage **training** activities, seminars, conferences or any group activity concerned with the communication/promotion/ extension/dissemination of technologies or research information developed by the institution;

- o Develop and circulate a variety of **publications** for different target audiences in consultation and with technical/research personnel.

- o Serve as a **liaison** of the research institution with intermediary agencies and various clienteles on matters related to research result promotion, transfer and utilization;

- o Organize and manage **public information activities** -- field days, field tours, exhibits, TV and radio coverages and lectures -- to promote the institution's work;

- o Serve as the public relations officer of the system (where manpower is extremely short, the staff of this extension-communication unit could double as PR personnel).

2. **Work through Intermediaries.** All countries have institutions performing extension activities, mass communication, mass education and other services such as banking, input

distribution, market assistance and local governance. It will be wise for the research system to develop linkages with these intermediaries and pass research outputs to them. This will be a good approach as it will not pose a competition to these institutions. On the contrary, for them to be effective with the public, they will need the technology and research information of the research system. Also, for practical management consideration, the research system does not have the kind and extent of resources required to do these much expanded activities.

3. **Be Selective, Work With Multipliers.** Multipliers are people whose roles in their organization potentially allow or make them circulate and diffuse information around, thus multiplying the efforts of the research system in the process. It is a good strategy to interface with these key people. More impact can be created and more people reached with limited institutional resources by concentrating the effort on these multipliers.

4. **Don't Compete, Collaborate.** There are agencies in the environment of the research system whose functions and norms are complementary and supplementary to its own. Some of these are: the government extension agency; non-government service oganizations; agricultural universities; input industries; and other similar research systems. Rather than compete or do things independently, much synergistic and collective effect will be accomplished through joint activities and collaboration with these agencies.

We conclude by quoting Dr. M.S. Swaminathan, one of the leading science philosophers and research managers of our time. In his response at the presentation ceremonies in which he was an awardee for community leadership of the Ramon Magsaysay Award on August 31, 1971, he gives credence to the need of using collaborative and teamwork approach in agricultural development. He says:

> The Indian achievement in wheat production leading to a near doubling of the total harvest serves to illustrate what can be accomplished, provided farmers, scientists, extension and communication experts and political and administrative leaders, all function like members of a symphony orchestra. Unless **orchestration of such players is done** a

scientific breakthrough may not necessarily lead to a production breakthrough (underscoring provided).

VIII. Understanding Bureaucracy and Administration of Research Project
- o Nature of Bureaucracy
- o Functions and Dysfunctions of Bureaucracy
- o Creative Bureaucracy for Administration of Research
- o Relationship Between the Scientific Staff and Research Support Personnel

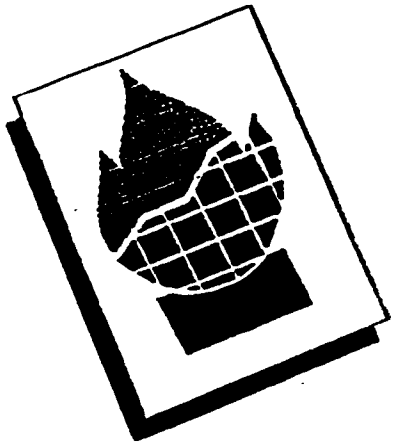
EXPECTED OUTPUTS

1. Group reports on research management cases
2. Individual or group recommendations

RESOURCE SPEAKERS/
FACILITATORS

Rodegelio B. Caayupan
Rogelio V. Cuyno
Melinda F. Lumanta
Romeo B. Obedoza
Nelson B. Querijero
Jaime C. Reyes
Jean A. Saludadez
Alvaro L. Soria
Gener L. Talatala

RESEARCH MANAGEMENT CENTER
UP AT LOS BAÑOS, COLLEGE, LAGUNA



# MANAGING SUCCESS in SCIENTIFIC RESEARCH

Date : 25-27 May 1989 and 1-2 June 1989

Venue : Institute of Forest Conservation UPLB

Facilitator: Research Management Center, College of Economics and Management, UPLB

Sponsor : Bureau of Animal Industry

## RATIONALE

No matter how well a research project is conceptualized and planned, if it is not properly implemented, it will not produce the desired results. Research productivity depends on the skills,teamwork, and mutually supportive relationship of three groups of performers in the research scenario --- the research manager, the researcher, and the support staff.

The research project manager/leader is the person responsible for administering the research project activities to attain the desired overall results of the project.

The researcher's responsibility is to use his/her technical expertise in the conduct of experiments to produce breakthroughs, technological innovations and recommendations in animal production.

No research undertaking would be successful without the administrative and research support staff who handle specific financial transactions and administrative matters. These they do within the bounds of government rules and regulations. They also provide support in clerical work, purchasing, manual labor, transporting/driving researchers to and from field areas, maintenance of equipment and facilities, and the like.

When all these contributions mentioned above will be channeled to a common purpose, greater efficiency and effectiveness of the research system will be attained.

## PURPOSE

This NBSR training course hopes to upgrade the research management "know-how" and "do-how" of BAI research project managers/leaders as well as to improve the working relationship between the research people and administrative-finance-support staff of the Bureau so that research activities will yield the desired outputs and eventually enable the animal industry to create development impact in the country.

## OBJECTIVES

Specifically,this course aims to enable the BAI participants to:

1. Verbalize the research mission, mandate, policies and thrusts of BAI;

2. Explain the basic concepts, principles and tools for effective management of research project;

3. Diagnose the present management process or system in BAI using the framework or norm established and presented in the training cases;

4. Develop fellowship with each other so that they will extend mutual cooperation in their work;

5. Recommend resolutions that will enhance his/her performance as a BAI research leader, support staff or researcher as well as suggest policies to improve BAI as a research organization/system.

## METHODOLOGY

This course will provide an interactive learning experience among the BAI participants. It will include workshop on case analysis using video tape recordings (VTR), illustrated lectures, sharing sessions and group work.

## COURSE CONTENT

I. Overview of Research Management
- The Creative Process
- The Scientific Process
- The Knowledge Worker
- The Nature and Characteristics of the Research Organization as a Social System (Including Parameters of Performance in a Research System)

II. The Research Project System
- The Nature/Characteristics of a Project
- The Environment of a Project
- Management Implications of a Project System
- Communication Within a Project System
  - Effective Interpersonal Communication
  - Handling Information Overload
  - Communication and Project Performance

III. Integrated Planning Framework for Research
- Goal-Setting
- Prioritization
- Log-Frame
- Strategic Planning
- Research Program Formulation (A Systems Approach)

IV. Managing A Research Team
- Nature/Characteristics of Research Approaches (Monodisciplinary, Multidisciplinary and Interdisciplinary)
- Managing Interdisciplinary Research Team

V. Managing Organizational Change
- Characteristics of Organizational Change (Planned and Unplanned Change)
- Reasons for Employees' Resistance to Change
- Management of Change Through Organizational Development

VI. Systematic Managerial Analysis as Applied to:
- Problem-Solving
- Decision-Making
- Potential Problem Analysis

VII. Effective Supervision in Research Project
- Nature/Characteristic of a Research Supervisor
- Supervisory Tools and Techniques
  - Leadership style
  - Motivation
  - Conflict and Conflict Management
  - Coordination
  - Time Management
  - Delegation and Giving Instruction

## SCHEDULE OF ACTIVITIES:

Day 01: 1:30-5:00 p.m. - Overview of Research Management

Film showing: "The Unfinished Miracle"

Day 02: 1:30-5:00 p.m. - The Nature and Culture of Scientific Organization"

Day 03: 1:30-5:00 p.m. - Management Culture for Research

Case-Discussion, "Your Kind of a Research Manager";

Day 04: 1:30-5:00 p.m. - Relationship Between the Scientific Staff and Research Support Personnel

VCR Case Presentation & Analysis, "Beyond Number People";

Day 05: 1:30-5:00 p.m. - Understanding the Functions and Dysfunctions of Bureaucracy

VCR Case Presentation & Analysis, "Functions and Dysfunctions of Bureaucracy";

Day 06: 1:30-5:00 p.m. - Creative Bureaucracy for Administration of Research

EVALUATION & CLOSING EXERCISES

RESEARCH MANAGEMENT CENTER
COLLEGE, LAGUNA 3720 PHILIPPINES

## Seminar-Workshop

# THE INTERDEPENDENCE OF RESEARCH & SUPPORT SYSTEM

**Theme:** Harmony of Research and Support Systems for Greater Performance

**Participants:** Researchers, Project Leaders and Heads of Administrative Services Department of Science and Technology

**Duration:** Sept. 19 - 29, 1989
1:30-5:00 p.m. MWF only

**Venue:** Dept. of Science & Technology, Bicutan, Taguig, Metro Manila

## RATIONALE:

Performance in a research system largely depends on the interdependence and mutual cooperation between the scientific and support staff. Science do not develop without scientists. Research will not be done in the absence of resarchers. In modern complex organization, there can be no successful research operation without adequate support of people who handle financial and other administrative matters.

But these two systems are not compatible in their nature, hence conflict, miscommunication and misunderstanding are expected to characterize their relationship. Research people are more self-centered, original, and creative in their work. Whereas, the support staff are guided by a bureaucratic system characterized by standardization and adherence to rules and regulations. There is a strong felt need to develop harmony between them for greater performance in research.

It is obvious that the two sectors in a reserch system will have to get along well for greater performance of the total system.

## PURPOSE:

The course intends to improve the harmony and working relationship between the researchers, research project leaders, and administrative support staff so that the mandate and the programs of the research system will be successfully attained.

## LEARNING OBJECTIVES;

Specifically, the course is designed to enable the participants to:

1. Verbalize the research mission, mandate, policies and thrust of DOST;
2. Diagnose the present management process or system in DOST;
3. Develop harmonious relation and understanding between the research workers on one hand, and the support staff on the other so both of them will extend mutual cooperation in their work;
4. Recommend steps to further improve their working relationship.

## COURSE CONTENT:

I. Overview of Research Management

II. The Nature and Culture of Scientific Organization

III. Management Culture for Research

IV. Relationship Between the Scientific Staff and Research Support Personnel

V. Understanding the Functions and Dysfunctions of Bureaucracy

VI. Creative Bureaucracy for Administration of Research

## METHODOLOGY:

The course will provide an interactive learning experience among the DOST participants. It will include workshop on case analysis using films, video tape recordings (VTR), illustrated lectures, sharing sessions and group work.

ourse Schedule

| | | |
|---|---|---|
| uly 23 | | Arrival of participants |
| uly 24 | | Opening Ceremonies/Unfreezing/ Fellowship |
| uly 25 | 8:30 | I. Overview of Agricultural Research Management |
| | | * Unique Features of Agricultural Research Management<br>R.V. Cuyno |
| | 10:30 | * System Approach and its Application to Research Management<br>R.B. Caayupan |
| | 1:30 | II. Project System |
| | | * Nature and Characteristics of a Project and their Management Implications |
| | | * The Project Environment<br>R.V. Cuyno |
| uly 26 | 8:30 | * Project Design and Development<br>R.V. Cuyno |
| | 1:30 | III. Management of R & E Linkage |
| | | * Typologies of Agricultural R & E Linkage<br>A. L. Soria |
| | 3:30 | * Technology Assessment<br>R.V.Cuyno/G.L.Talatala |
| uly 27 | 8:30 | * Process and Strategies of Promoting Research Results (The "ZM" R & E Task Force)<br>R.V.Cuyno/J.A.Saludadez |
| | 3:30 | * Management of Interagency Network and R & E Projects<br>R.V.Cuyno/J.C.Reyes |
| uly 28 | 8:30 | IV. Systematic Managerial Analysis (SMA)<br>R.V.Cuyno/G.L.Talatala |
| uly 29 | 8:30 | Continuation of SMA |
| | 10:30 | Activity Planning |
| | 1:30 | Workshop |
| uly 30 | 8:30 | Workplan presentation<br>G.L. Talatala |
| | 1:30 | Closing Ceremonies |

**The Faculty**

**Rogelio V. Cuyno**, Doctor of Philosophy in Educational Management. Rural development management, development communication, extension education, non-formal education and training, agricultural development, and research management.

**Jaine C. Reyes**, Doctor of Public Administration (on-going). Development communication, research and development management, project development and management, training management, rural sociology, urban-rural planning, human ecology.

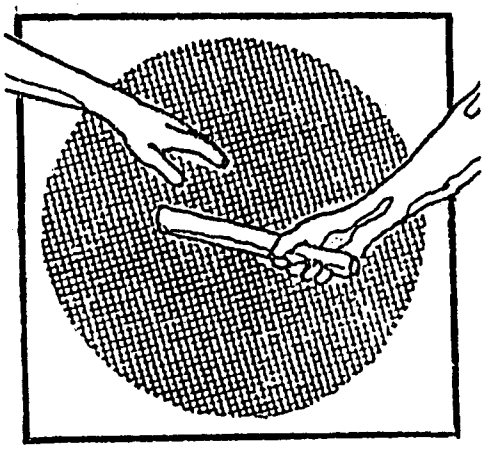
**Rodegelio B. Caayupan**, Doctor of Philosophy Community Development (on-going). Rural development management, community organization, agrarian reform, project management, training management, cooperative administration/management.

**Gener L. Talatala**, Master of Management in Rural Development Management. Agriculture, animal science, project development and management, organization and management, community organization, farm management, training design and management.

**Alvaro L. Soria**, Master of Agrarian Studies. Community organization, agricultural development, land reform, extension education, rural development management, project and training management.

**Jean A. Saludadez**, Master of Science in Development Communication (on-going). Educational and science communication, technical writing, communication research, audio-visual (film) production.

# MANAGEMENT OF AGRICULTURAL RESEARCH AND EXTENSION LINKAGE



Date: 24-30 July 1988
Venue: Institute of Forest Conservation
U.P. Los Baños
Facilitator: Research Management Center
U.P. Los Baños
Sponsor: Northern Samar Integrated
Rural Development Project

## Rationale

Success in research systems can no longer be guaranteed by scientific and technical expertise alone. An additional component --institutional, organizational and leadership competencies are demanded to produce the desired results. Resources have to be managed carefully to obtain maximum mileage. Personnel with diverse interests and expertise have to be coordinated and welded into a working team. And, research results have to be communicated to the right audience for their application. All supervised and managed research undertakings will ensure an effective and efficient performance of research systems and a continuing support and sponsorship from the environment.

It has now become common practice in organization and management to use a project as the basic unit of work. Some authors define a project as a unit of work with a definite time-frame, budget, and performance specifications. The complexity of a project demands a unique management approach. The project involves mobilization of functional specialists to undertake a variety of diverse tasks and utilization of various resources to complete the project. Technical competence and regulated autonomy of personnel are major contributing factors towards the attainment of goals rather than the exercise of authority in the traditional organizational hierarchy.Communication, coordination, and cooperation are imperatives because of rapid change in ideas, technology, and implementation mechanics.

Modern-day research projects are mission-oriented. Researchers are called upon to relate to the problems of the society. Today, research cannot be defined on self-evidence. Researchers now have to focus their efforts to the needs of the beneficiaries of their projects. Hence, extension and communication of results has now become an integral part of the whole research enterprise. This are means that the management of agricultural research includes the function of promoting/communicating/extending research results to various end-users.

## Goal

The long range aim of this course is to be able to transcend the present capabilities of the participants by developing their supervisory and managerial skills in undertaking research and extension activities by enriching them with applicable tools, concepts and principles in research and extension linkage.

## Objectives

Specifically,this course intends to enable the participants to:

1. Verbalize and practice the various tools, principles, concepts in promoting the research results through research and extension linkage;
2. Exercise the supervisory and managerial tools and skills needed in implementing research and extension projects; and
3. Formulate a campaign plan for their service area to communicate/promote results of agricultural research based on present needs and opportunities.

## Methodology

Lecture-discussion,case analysis, group-work, game, simulation,audio-visual(film,overhead and videotape) presentation and field trip.

## Course Content

I. Overview of Agricultural Research Management
   * Unique features of agricultural research management
   * Systems approach and its application to research management

II. Project System
   * Nature and characteristics of a project and their management implications
   * The environment of a project
   * Project design and development
     - o log-framework
     - o priority setting
     - o project formulation

III. Management of Research and Extension Linkage
   * Typologies of agricultural research-extension projects
   * Technology assessment
   * Process and strategies of promoting research results
   * Management of interagency network
   * Management concerns in managing R & E projects

IV. Systematic Managerial Analysis
   * Problem-Solving
   * Decision-Making
   * Potential Problem Analysis
   * Programming/Activity Planning

# APPENDIX "I"

Drexel University course description

# APPROPRIATE TECHNOLOGY

# AT

# DREXEL UNIVERSITY:

# A NEW UNDERGRADUATE CURRICULUM

Richard L. Rosen

Beginning September, 1986, Drexel University of Philadelphia, PA will initiate its appropriate technology curriculum. Unique for its engineering basis and for its component of cooperative education, the new program will be able to attract students who are disposed to helping citizens of less developed countries help themselves. Herein is presented the background to, description of, and hopes for this new curriculum.

Five years ago, when Bill Zuspan, Associate Professor of Engineering at Drexel University spent five months in Haiti, he became extremely interested in the problems of that country and returned home with an enthusiasm for seeking solutions to those problems through the application of appropriate technology. Having seen the needs of the Haitian peasant first-hand, Zuspan was convinced that Drexel engineering students could help to solve some of these problems within the context of an engineering design course. If presented with a situation, they could define the problem and come up with a tentative solution. Perhaps, given time, they could also construct a prototype which could be sent to Haiti (and other less developed nations) for implementation.

Upon his return to Philadelphia, Zuspan made contact with George McRobie, a visiting professor at the University of Pennsylvania and perhaps the world's foremost expert on appropriate technology. McRobie encouraged Zuspan to the extent that he (Zuspan) almost enrolled in the Penn program. The practical result of this meeting was that three years ago Zuspan established two appropriate technology courses in the engineering college at Drexel.

The first of these courses, Design to Meet Third World Needs, is taught at the freshman level. Its purpose is to make students aware of the special needs of less developed countries and to encourage preliminary designs that could serve as a basis for further development. The second course, Appropriate Technology and Engineering Design, is for upper class students who design, and occasionally construct, more advanced devices which can frequently be implemented in a less developed nation.

Out of this course have come both some practical designs and a fervent interest in appropriate technology among students.

The first practical device to result from this course came quickly. Two senior mechanical engineering students designed and constructed a device which enabled a bicycle to be used as a power source. A simple connection to a table equipped with a shaft and a saw blade enabled the user to cut a 4-by-4 in about 20 seconds. Plans for this bicycle-powered saw have been sent to Haiti where a similar device, with a grinding wheel replacing the saw blade, has been constructed for use in sharpening machetes. The device could also be used for any job requiring rotary motion, or, with proper adaptation, piston-like motion. Furthermore, other design groups have worked to eliminate metal parts from the design so that it might be more easily adapted in places where metal is not readily available.

While the bicycle-powered saw plans were being sent to Haiti, a request for the solution to a more immediate problem was sent to us at Drexel. The problem concerned a Haitian foot bridge which was periodically washed away by flooding waters. Without the bridge, Haitians were forced to walk several miles each way to another point on the river where crossing was possible. Government response to the repair of the bridge was slow leaving the peasants with only one alternative; to walk the several miles. Drexel students were challenged to design a bridge that would be simple enough for the local citizens to build and to maintain. It was to be built , as much as possible, from local materials which could be gathered for minimal cost. Additional parts could cost no more than $60 since the citizens of the area would pay for, and ultimately own, the bridge. Because the Haitians were involved in the construction, any repairs required in the future could be handled locally.

The design students responded enthusiastically producing the design of a bridge which swiveled. During the flooding season the bridge could be pivoted away from the waters and, when the waters subsided, it would be returned to its functional position. Perhaps the most surprising aspect of the project, especially in these days of cost overruns, was that the bridge only cost $48, 20% less than projected .

These successes led Zuspan and his design co-teacher, Richard Rosen, an Associate Professor of history (history of science and technology) with and undergraduate degree in mechanical engineering, to consider the possibility of a full-fledged, engineering-based, undergraduate program in appropriate technology. Encouraged again by George McRobie, by Drexel's Dean of Engineering, and by Drexel's desire to move into new areas, Zuspan and Rosen developed a proposal for such a program. The goal was to create an unique approach to appropriate technology. Zuspan and Rosen considered Drexel's strong points, a solid reputation in engineering and a long-standing cooperative education component, to be the core of the new program. Furthermore, new programs in International Studies and International Business would help to add the necessary global dimension.

In most technical education in the United States, there is little emphasis beyond preparation for the society in which we live. Most engineering graduates are poorly prepared to deal with global problems simply because they have had a narrow, Western culture mind-set. On the other hand, students from the few appropriate technology programs which exist in the United States, may be well-prepared to deal with global problems, but they lack the technical background necessary to solve many of them. Only when both of these types of skills are fused can we begin to create a practical means to solve the problems of the less developed nations.

The Drexel program consists of a broad-based engineering curriculum which includes courses from all major engineering areas (Civil, Mechanical, Materials, Electrical, and Chemical). With a firm basis in mathematics, science, and engineering science, appropriate technology students will take upper level courses leading to expertise in water supply, building and construction, energy sources, materials, water and waste treatment, nutrition, environmental issues, and/or small electrical devices. Simultaneously, the curriculum requires a global perspective. Through courses in world history, economics, international relations, and anthropology, appropriate technology students will gain the necessary perspective to prepare them for Third World needs.

The strongest part of the Drexel curriculum in appropriate technology is, perhaps, the cooperative education aspect. Since 1919, Drexel engineering students have been required to spend up to 18 months of their five-year stay at the university in industry. Operating on the quarter system, Drexel has four quarters of equal length throughout the academic year (September to August). After the freshman year, students alternate six months of school with six months of industry for three years. The senior year is a regular, nine-month academic year. For the normal engineering student, this requirement usually means three six-month periods of employment in private industry or with a government agency. However, for the appropriate technology student, this co-op period will be spent in a less developed nation, or and underdeveloped area of this country.

During these co-op periods, appropriate technology students will come into first-hand contact with the real problems of the non-western world. During the first of these three periods (sophomore year), students will become oriented to their new societies and will become aware of the cultural differences they face. By the latter part of the period, they should be able to determine some of the basic problems the society faces and begin to think about ways of solving them. During the second and third co-op periods, the student should be able to begin making real progress toward the solutions of some problems. Our previous experiences are responsible for our optimism.

Two years ago, a materials engineering student, Joe Talento, spent the summer in Zaire on a project supported by Habitat for Humanity. His job was to help the local inhabitants learn how to make ceramic roofing tiles from local clay. While there, he noticed that there was need for the people to cross a large, nearby lake. Local boats were poorly constructed and therefore, dangerous. Upon his return to the U.S., Mr. Talento designed a boat, using only local materials, to accomplish this task safely. The design has been sent back to Zaire where it is currently being implemented. In addition, Drexel students have spent much time in Haiti where they have helped in the design and construction of a bridge, a church, and, currently, a food drying system and

a Goan-type pig raising/human waste disposal system.

To integrate the technical, and global aspects of the program with these and other co-op experinces, three new appropriate technology courses will be created. These courses will use case studies and student "debriefing" as a basis for further work. By sharing experiences and comparing cultures, students can begin to see a more universal approach to the problems of less developed nations. These courses will also provide the opportunity for students to begin the design phase for those problems which they observed during their co-op sessions.

To enhance the possibility of constructing those designs, Drexel is planning to build an "exploratorium" in the new engineering building which will be under construction shortly. The "exploratorium" will be a lab-type area with various types of wood-working and metal-working equipment. Students will be able to build models and/or prototypes of their designs so that they may carry these back during their next co-op period. Further- more, students will be encouraged to use as much native materials as possible, eliminating the need for purchased products.

The capstone to the appropriate technology curriculum is the senior design project. This project, required of virtually all Drexel engineering students, enables teams of students to spend an entire academic year working on a single project. Having spent eighteen months in a less developed country, and with the bulk of their coursework behind them, students will have the opportunity to design, and to construct those devices which they have deemed most important. These projects can be sent back to those countries needing them or they can be carried by the next "generation" of co-op students who will replace the graduating seniors.

Our major problem will be to secure the necessary co-op positions in less developed nations. To this end, we have contacted numerous agencies throughout the world to determine the possibility of such placement. We are currently cooperating with Operations Crossroads Africa, a group which has many contacts in various countries in Africa and Latin America. Through this cooperative effort we hope to

establish permanent working agreements with local institutions such as universities and government agencies which will serve as liasions between our students and the local population. We will need money to help defray our students' cost of transportation and to set up appropriate technology centers to which we can send students.

Our own contacts in Haiti have produced a tentative cooperative agreement with the Université Roi Henri Christophe in Cap-Haitien and we have received encouragement from the College of Arts, Science, and Technology in Kingston, Jamaica. As mentioned above, Habitat for Humanity was instrumental in the placement of a student in Zaire; we hope to continue our good relationship with them. Through these efforts in less developed countries, we hope also to encourage citizens of these countries to come to Drexel to learn engineering and then to return to their native lands where they can provide a permanence to the appropriate technology effort.

While our program begins officially in about two weeks, the late final approval of our proposal (May 20) has made it dufficult to secure a group of 15-20 students to make up our freshman class. Current estimates are that there are five, but we see a strong possibility of several more freshmen transfering from other engineering curricula here. Our recruiting efforts for 1987 have begun in earnest, and we are optimistic that we will have little trouble meeting our goals.

Our pool of students will also be increased in future years by a number of transfer students currently enrolled at liberal arts schools with which we are establishing working agreements. We have two 3-3* programs in operation and are working on three more. These agreements will allow colleges with non-engineering-based

*This is Drexel's version of the traditional 3-2 program in which students spend three years at a liberal arts school and two years at an engineering school and receive two degrees (BA &BS). The 3-3 is slightly longer because of Drexel's cooperative education requirement.

appropriate technology programs to provide the strong global background while Drexel will provide the engineering skills.

The uniqueness of our program is two-fold. First, to the best of our knowledge, it is the only engineering-based appropriate technology in the United States, and, secondly, the cooperative education component provides vital on-site experience in the very nations we are trying to help.

DISTRIBUTION REQUIREMENTS - APPROPRIATE TECHNOLOGY PROGRAM

| Subject Area | Credits |
|---|---|
| Science | 28.5 |
| Chemistry...N471...N472; Biology...N203 | |
| Physics...N706...N707...N708...N709 | |
| Mathematics | 27.0 |
| Math...N501...N502...N503...N504...N505...N518 | |
| Computers...N602 | |
| Humanities/Communications | 12.0 |
| Writing...R101...R102...R103...R270 | |
| Culture | 24.0 |
| History...S207...S208 | |
| Political Science...S676...S310 | |
| Anthropology...S935... S--- | |
| Psychology...S750 | |
| Business | 9.0 |
| Economics...B411...B412...B438 | |
| Engineering Science | 27.0 |
| Mechanics...E321...E322...E323; EE...E411...E414 | |
| Thermo...E006...Transp. Phen....E110...Materials...E801 | |
| Freshman Electives | 6.0 |
| Required...E011 | |
| Suggested... E012...E019 | |
| Design Project | 8.0 |
| E020...E021...E022 | |
| Appropriate Technology Sequence | 9.0 |
| AT I...AT II...AT III | |
| Engineering | 16.0 |
| E220...E290...E225...E233...E254 | |
| Technical Concentration | 16.5 |
| Individual Program of Courses | |
| Free Electives | 7.0 |

# AT COURSE SCHEDULE

## Freshman Year

| 1st Term | | 2nd Term | | 3rd Term | |
|---|---|---|---|---|---|
| N501 -Calc. I | 4 | N502 - Calc. II | 4 | N503 -Calc. III | 4 |
| N602 - Comp. Prog. | 3 | N706 - Physics I | 4.5 | N707 - Physics II | 4.5 |
| N471 - Chem. I | 4 | N472 - Chem. II | 4 | N203 - Biol. Sci. | 3 |
| R101 - Comp. I | 3 | R102 - Comp.II | 3 | R103 - Comp. III | 3 |
| E019 - AT Design | 2 | E0-- - Global Persp. | 2 | E0-- AT Design II | 2 |
| | 16 | | 17.5 | | 16.5 |

## Sophomore Year

| 4th Term | | 5th Term | |
|---|---|---|---|
| N505 - Calc. IV | 4 | N504- Linear Alg. | 4 |
| N706 - Physics III | 4.5 | N709 - Physics IV | 4.5 |
| E321 - Statics | 3 | E322 - Mech. of Matls. | 4 |
| AT I - Approp. Tech. I | 3 | S935 - World Views | 3 |
| S207 - 20th C. World I | 3 | Elective | 3 |
| | 17.5 | | 18.5 |

## Pre-Junior Year

| 6th Term | | 7th Term | |
|---|---|---|---|
| N518 - Diffl. Equatns. | 4 | E110 - Transport Phenom. | 4 |
| E006 - Thermo. | 4 | E801 - Fund. Matls. | 4 |
| E220 - Engr. Geology | 4 | S208 - 20th C. World II | 3 |
| E323 - Dynmaics | 4 | AT II - Approp. Tech. II | 3 |
| | | S270 - Tech. Writing | 3 |
| | 16 | | 17 |

## Junior Year

| 8th Term | | 9th Term | |
|---|---|---|---|
| B411 - Econ. I | 3 | B412 - Econ. II | 3 |
| E290 - Hydraulics | 3.5 | E411 - EE Circ. & Sys. | 3 |
| E225 - Soil Mech. | 4 | E414 - EE Instrum. Lab | 2 |
| E233 - Constr. Matls. | 3 | S--- - Intercultural Training | 3 |
| S676 - Politics Dev. Natn | 4 | Electives | 6 |
| | 17.5 | | 17 |

## Senior Year

| 10th Term | | 11th Term | | 12th Term | |
|---|---|---|---|---|---|
| E020 - Sr. Design I | 2 | E021 - Sr. Design II | 2 | E022 - Sr. Design III | 4 |
| E254 - Hydrology | 3 | B438 - Econ. Devpt. | 3 | S310 - Tech. & Wld. Community | 3 |
| AT III - AT. III | 3 | Electives | 6 | Electives | 4 |
| Electives | 6 | S750 - Human Engr. | 3 | | |
| | 14 | | 14 | | 11 |

E011 (Graphical Communications) is required of all students. It should be inserted into the student's course of study as early as is convenient.

Hydrology (E254) is vital to all AT majors. Hence, this course and its prerequisite, E290, Hydraulics, are required.

During the 9th term, the course Intercultural Training (S---) is required. This course is designed to inform students of various cultural differences to be encountered in developing nations and to help them to communicate with the people there.

While students may choose to study a language formally, experience has shown that language can be acquired during the co-op period. This is especially true for African countries where the local language is not one which is taught at the University. Furthermore, local dialects of French and Spanish frequently differ significantly from the formal language taught in

class. Finally, acquiring familiarity with a foreign language often requires five terms of study which reduces significantly the opportunity to select other, more important courses.

Additional courses will be selected by the student based on his/her individual interests. These courses must meet the distribution requirements described on page 7. A listing of some suggested, but not required, courses appears below.

N713 - Solar Energy
E643 - Solar Thermal Sys.

E201, E208 - Theory of Structures I, II
E205 - Structural Theory

E255 - Hydrology-Grnd Water
E256 - Water Resrcs. Design

E295 - Envirm. Engr. I
E257 - Chem. & Bio. Aspcts of Env. Engr.
E258 - Unit Proc.-Water, Waste Trtmt.

E223 - Environmtl Issues

E259 - Water & Waste Trmt Plant Des.

E5-- - Small Elec. Machinery

J401 - Intro. Nutrition

N760 - Meteorology

E619 - Ht. Transfer

E654 - Degradation of Matls.

Additional, non-technical courses for electives in AT program:

R124 - Non-Western Literature
R125 - Topics in World Literature
R551 - Comparative Religions
S271 - Modern Latin America
S273 - World and China
S274 - East Asia
S275 - Ideologies of Revolution
S305 - Technology in Historical Perspective
S307 - Social Implications of 20th C. Technology
S643 - International Politics
S668 - Comparative Ideologies
S674 - American Foreign Policy
S752 - Environmental Psychology
S881 - Culture and Values
S921 - Political Sociology
J164 - History of Modern Architecture or Architectural History from new Architectural Engineering Program

# E070: APPROPRIATE TECHNOLOGY II

## SUMMER, 1989 TUESDAYS, 3:30-6:00

## Professors Sylla, Rosen, & Zuspan

**COURSE DESCRIPTION**

Various innovative technologies which hold great promise for meeting the basic needs of the poor throughout the less developed world have emerged from the Appropriate Technology Movement. However, much work remains to be done on the dissemination of these technologies through various economic and institutional channels of technology transfer and diffusion. This seminar will examine feasibility studies and project planning methods in the analysis of AT projects (e.g., energy, transportation, food processing, construction, agriculture, aquaculture) and institutional settings (e.g., cooperatives, credit unions) with the intention of identifying promising applications of those technologies within the developing world. The objective is to introduce students, through class discussions and research papers, to the extension of feasibility studies and project management methods for use in the planning investigiation of AT projects.

**TEXTS**

Carr, Marilyn, ed. *The AT Reader: Theory and Practice in Appropriate Technology.* New York: Intermediate Technology Development Group of North America, 1985.

Darrow, Ken, and Saxenian, Mike. *Appropriate Technology Sourcebook.* Stanford, CA: Volunteers in Asia, 1986. (Copy also located in the AT microfiche collection in the A.T. office, 3-240)

Schumacher, E.F. *Small is Beautiful: Economics as if People Mattered.* New York: Harper and Row, 1975.

Reading assignments will come from the *AT Reader* and from class handouts. Schumacher's, *Small is Beautiful*, should be read in full as soon as possible. By mid-July, it will be assumed that you know this book. The *AT Sourcebook* and the microfiche collection that accompanies it should be used for developing project ideas and information. The *AT Reader* also has many articles on specific types of technologies and can be used for project ideas as well.

## CLASS SCHEDULE

| DATE | TOPIC | READING ASSIGNMENT |
|---|---|---|
| 6/20 | General Course Orientation | |
| 6/27 | Introduction to Approp. Technology<br>Discussion of Projects | |
| 7/4 | No Class | AT Reader (ATR) : Ch. I, handouts on feasibility studies |
| 7/11 | Introduction to Feasibility Studies<br>Discussion of Decision Evaluation in Appropriate Technology | ATR: Ch II |
| 7/18 | Feasibility Studies continued<br>Introduction to Linear Programming | ATR: Ch. III, part 1, part 2 (Rao, Engel, Carr) |
| 7/25 | Creativity Issues in Appropriate Technology<br>Sample Project Discussion | ATR: Ch. IV, part 1, (Intro., Mukhopadhyay, Ayres), part 2, (p. 208); Ch. V, Part 1 |
| 8/1 | Midterm Project Presentations | ATR: Ch. V, Part 2; Ch. VI Part 1 (Intro., Edmonds, Fathy, Harper), Part 2 |
| 8/8 | Feasibility Studies continued<br>Business Decision Theory - Product Selection | ATR: Ch VI. Part 3; Ch. VII, Part 1; Ch. VIII |
| 8/15 | Feasibility Studies continued<br>Business Decision Theory - Process Selection<br>Quiz | ATR: Ch. IX |
| 8/22 | Final Project Presentations | ATR: Ch. X |

**Important Dates:**

| | |
|---|---|
| 7/10 | Project proposals due for review and approval |
| 8/1 | Midterm project presentation and review |
| 8/15 | Short quiz |

8/22 Final project presentations

## COURSE REQUIREMENTS

Each student will be responsible to prepare a Feasibility Study during the course of the semester. The study should be no less than 15 pages each (not including diagrams), and the topics should be cleared with the instructor in advance. The research materals for this study may be gathered from the VIA Appropriate Technology Sourcebook Microfiche Collection, the VITA Microfiche Library and other sources. All of the seminar papers will be presented and discussed in class (approximately one-half hour will be allocated to the discussion of each paper).

The Feasibility Study should include the following: (1) a description of the particular technology and its current and/or prospective applications; (2) an assessment of the suitability of the technology for a given cultural/regional context and/or a set of resource constraints which typify less developed countries; (3) a description of one or more proposed applications for the selected technology.

Course grades will be based on the following criteria:

30% - Class participation and Quiz
20% - Midterm presentation
50% - Final presentation and paper

# PROPOSED TOPIC FOR SENIOR PROJECT DESIGN

PROJECT TITLE/TOPIC: Highly Efficient Family of Periodic Motion Based Energy Source Systems

FACULTY ADVISOR/CONSULTANT: Dr. C. Sylla & Dr. R. Rosen
Room 217, Building 6, X- 1791

DEPARTMENT: MEM, CEE, CIV.Eng, MAT, Appropriate Technology

PROPOSED GROUP COMPOSITION: 3 - 5

POTENTIAL EXTERNAL FUNDING: Possible through AID and A.T. International Organizations

ABSTRACT:

The goal of this project is to develop an alternative energy source using appropriate technology. Based on a periodic motion pendulum systems; this energy source and associated mechanisms are to be used to pump well water from various depths for farm irrigation and local water supply in developing countries.

Human energy will be used to start and to restart the apparatus as needed; however, the frequency of restart must be kept at a minimum. Therefore, the emphasis is for highly efficient and low cost apparatus suitable for just about any area where construction and operating conditions are generally unfavorable.

The role of the project team is to propose and design a family of at least three such feasible alternative systems (and perhaps build a prototype) with detail calculations and characteristics of the various components. In addition, practical implementation and operating guidelines must be provided.

# PROPOSED TOPIC FOR SENIOR PROJECT DESIGN

PROJECT TITLE/TOPIC: Design Investigations of Experimental Sawdust Based Wood Briquet Machine

FACULTY ADVISOR/CONSULTANT: Dr. C. Sylla & Dr. R. Rosen
Office: Room 217, Building 6, X-1791

DEPARTMENT: MEM, MAT, Appropriate Technology

PROPOSED GROUP COMPOSITION: 3 - 5

POTENTIAL EXTERNAL FUNDING: Possible through AID and A.T. International Organizations

ABSTRACT:

The objective of this project is to conduct a design investigation of an appropriate technology based wood briquet production machine. The briquets are for use in cook-stoves, and will be made from sawdust, wood chips or other suitable materials easily available in developing countries. The manufacturing process is based on high temperature and high compression. The production rate goal is about 80 briquets of 18 inches in length per hour. While the shape of these briquets is not fixed, cylindrical or flat and rectangular or square shapes are most desirable. The major emphasis is on a low cost efficient and simple machine. Guidelines for quality control of the production process must also be included.

# APPENDIX "J"

Université de Technologie de Compiègne -- program description

UNIVERSITE DE TECHNOLOGIE DE COMPIEGNE

1er Décembre 1989

# PROGRAMME D'ACTIVITES
# MANAGEMENT ET DYNAMIQUE INTERNATIONALE

## ECONOMIE ET GESTION
## 1989-1990

## OBJECTIFS

Le programme de l'année universitaire 1989-90 de la Division "Management et Dynamique Internationale" constitue la seconde étape de développement du programme visant à développer à l'UTC un pôle de compétences en "Maitrise des Choix Technologiques" initié en Novembre 1988.

Ce programme comprend des activités :

- d'enseignement
- de complément à la formation d'ingénieur
- de formation doctorale
- de recherche
- de documentation
- de publication et de communication

## 1 -ENSEIGNEMENT

| | | |
|---|---|---|
| **GE10** | Fondements de l'économie | Bertrand BELLON<br>Simone MEYSSONNIER |
| **GE 15** | Fondements de la gestion | François ROMON |
| **GE 20** | Economie industrielle | Emmanuel LE ROCH |
| **GE 21** | Systèmes économiques comparés | Jean-Marc POINTET<br>Isabelle CLERMONT |
| **GE 22** | Economie internationale | Nathalie LAZARIC<br>Antje BURMEISTER |
| **GE23** | Transferts de Technologies et pays en voie de développement | Alain JM BERNARD |

.../...

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| | | |
|---|---|---|
| **GE 24** | Systèmes de développement technologique comparés | |
| **GE 25** | Gestion et organisation de la production | Yves BOUCHARD |
| **GE 26** | Gestion des ressources humaines et relations sociales | François ROMON |
| **GE 27** | Analyse et gestion financières de l'entreprise | Simon PARIENTE |
| **GE 29** | Gestion Internationale de la firme | Jean ESMEIN<br>Serge MBAPPE |
| **GE 35** | Stratégies de l'entreprise | Gabriel AUFAURE |
| **GE 36** | Marketing | Jean François LEGUAY |
| **TN 15** | Stage de gestion de l'entreprise | François ROMON |

**Responsable de l'enseignement : François ROMON**

## 2 - CONSOLIDATION DE LA FORMATION D'INGENIEUR

- **Mineur Technologie et Dévelopement International des Entreprises (TDIE).** Le mineur est attribué aux élèves ingénieurs qui ont satisfait à 4 UV spécifiques du programme de Gestion-Economie + 2 UV de langue + un stage à l'étranger de 6 mois + le séminaire annuel de Géopolitique et Stratégie .
**Responsable : Bertrand BELLON**

- **Séminaire géo-politique et stratégie (GE 90)** organisé chaque année au mois de janvier pendant une semaine dans le cadre de la formation des ingénieurs aux activités internationales.
**Responsable : Alain BERNARD et Jean ESMEIN**

.../...

**FACE** : Programme de Formation au Commerce Extérieur, programme de bourses pour des séjours en entreprise à l'étranger, complémentaire au stage (branche 03) ou au projet d'ingénieur.
**Responsable : Emmanuel LE ROCH**

## 3 - FORMATION DOCTORALE

- **Cours doctoral d'économie industrielle (14H annuelle)**
**Responsable : Bertrand BELLON**

- **Cycle de conférences** sur la **Maîtrise des Choix Technologiques** avec invitation de spécialistes Français, Américains, Italiens et Britanniques (12 conférences annuelles).
**Responsables : Bertrand BELLON et Jean ESMEIN**

- **Formulation d'une demande d'habilitation à délivrer un Diplôme d'Etudes Approfondies (DEA) en Maîtrise des Choix Technologiques** auprès du Ministère de l'Education Nationale pour 1990/91
**Responsable : Bertrand BELLON**

- Formulation d'une **demande de DESS** pour 1991-1992
**Responsable : Simon PARIENTE**

## 4 - RECHERCHES EN COURS

- 7 doctorants (en collaboration avec l'Université de Paris-Nord).
- Astrid BERNI,
- Antje BURMEISTER,
- Isabelle CLERMONT,
- Nathalie LAZARIC,
- Emmanuel LE ROCH,
- Serge MBAPPE,
- Jean Marc POINTET.

- 3 recherches commanditées par le **Ministère de l'Industrie** sur des questions de politiques industrielles en Italie, Grande Bretagne et Etats Unis.
**Responsable : Bertrand BELLON**

.../...

**- 2 recherches UTC**

**a)** Ecriture d'un glossaire de concepts utilisés dans l' analyse économique des problèmes technologiques .
**Responsable : Nathalie LAZARIC**

**b)** Etude sur les processus d'introduction des nouvelles technologies de production dans les PMI (cas de services en automatisation).
**Responsable : Emmanuel LE ROCH**

- **Projet de recherches** en cours d'élaboration en collaboration avec la Rensselaer School of Management (N.Y., USA) ayant pour thème : "Strategic Use of Technology".
**Responsables : Léon BADGUERAHANIAN/Simon PARIENTE/Bertrand BELLON**

Ce projet devrait pouvoir être jumelé avec un projet de recherche en cours auprès du Ministère de la Recherche et de la Technologie (programme technologie-emploi-travail) sur les conditions technologiques des restructurations industrielles.

**5 - DOCUMENTATION**

Une documentation est en cours de constitution - elle doit être composée de 2 grands ensembles :

- **Documentation pédagogique générale** à la Bibliothèque Centrale,

- **Documentation de recherches** en salle C. 216 - relative aux domaines suivants :

- Economie de la technologie,
- Gestion de la technologie,
- Histoire des techniques,
- Stratégie industrielle,
- Economie industrielle,
- Politique industrielle,
- Economie internationale,
- Economie comparée des Pays Industrialisés.

**Responsable : Nathalie LAZARIC**

.../...

## 6 - PUBLICATIONS ET COLLOQUES A VENIR

- Les chercheurs de l'équipe participeront au cours de l'année 1989-90, à une douzaine de manifestations nationales et internationales avec communications.

- Prévision de publication de 3 nouveaux Cahiers de Recherche

- Publication de divers articles.

- Publication mensuelle de la revue **"les cahiers du partenariat"** en collaboration avec l'Université de Paris Nord et RDE.

- Participation au Comité de rédaction de la **"Revue d'Economie Industrielle".**

L'équipe participe enfin au groupe de Recherche du CNRS en **Economie Industrielle** et à **l'Ecole Méditerranéenne d'Eté** d'Economie Industrielle.

## 7 - COMPOSITION DE L'EQUIPE

**Enseignants-chercheurs :**

Gabriel AUFAURE,
Bertrand BELLON,
Alain JM. BERNARD,
Jean ESMEIN,
Nathalie LAZARIC,
Emmanuel LE ROCH,
Serge MBAPPE,
Simon PARIENTE,
François ROMON.

**Chercheurs :**

Astrid BERNI,
Antje BURMEISTER,
Isabelle CLERMONT,
Thierry CORNU,
Jean Marc POINTET.

**Enseignants :**

Jean Claude BRAULT,
Jean François LEGUAY,
Jean Yves LOISEL,
Isabelle LEBORGNE,
Simone MEYSSONNIER,
Christian MOMOT.

**Secrétariat :**

Maïté ROUSSEL

**Membres directement associés à l'activité :**

Léon BADGUERAHANIAN (Génie Chimique),
Thierry MOUTON (Cahiers du partenariat).

**Centres de recherches associés :**

Université de Paris-Nord,
Université de Paris Dauphine,
Université de Lyon II (M. JACOT, D. FORAY)
BETA, Université de Strasbourg I (P. LLERENA, P. COHENDET),
INSTN, Paris, (P. MAISTRE)
CREDIT, Université de Quebec à Montréal (J. NIOSI),
DAEST, Université de Venise ( P. PERULI),
Académie des Sciences, Moscou (A. KOUDRIATSEV, A. DYNKIN),
Rensselaer Polytechnic Institute, TROY, NY, USA (MMs. ABETI et MORONE)

UNIVERSITE DE TECHNOLOGIE DE COMPIEGNE

# DEVELOPPEMENT D'UN POLE DE COMPETENCE MANAGEMENT DE LA TECHNOLOGIE A L'UTC

## LE CONTEXTE :

L'UTC a choisi de développer dans le cadre du **Département Technologie et Sciences de l'Homme** une nouvelle compétence à la fois complémentaire et nécessaire au développement technologique.
L'un des thèmes retenu est celui de **la Maîtrise des Choix Technologiques** dans lequel l'UTC a engagé des actions depuis quelques années, en particulier avec le **Programme Européen de Management de la Technologie** réalisé en coopération avec le **Cranfield Institute of Technology** et la **Business School de Stockolm.** Plusieurs activités originales ont été développées dans ce cadre : Journée internationale **Gérer la Technologie** à l'UTC en Janvier 1988 ; 5ème conférence internationale de transfert Université/Industrie, **Technology transfer conference**, en Septembre 1988 ; collaboration aux travaux de l'**European Industrial Research Management Association** ; participation aux travaux de **l'Industrial Research Institute** de New York; Cooperation avec le **Rensselaer Polytechnic Institute** de l'état de New York ; coopération avec l'**ANRT**.

En parallèle, l'accent a été mis sur la **formation** des ingénieurs en sciences de l'Homme : en particulier, à l'**économie** et à la **gestion** , notamment une formation aux **Relations Internationales des Entreprises**, ainsi qu'à celles sur les **mutations technologiques** et leurs conséquences sur l'évolution de la Société.

La réflexion poursuivie autour du thème Management de la Technologie s'est enrichie des expériences de l'UTC dans sa propre gestion des ressources technologiques et humaines et son approche spécifique en matière de **gestion de l'innovation** avec le développement de **Gradient,** de **Divergent** et le projet du **Centre de transfert** de Royallieu II.

.../...

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## L'ENJEU

Il n'y a pas d'amélioration de la compétitivité régionale, nationale ou européenne sans modernisation industrielle et sans innovation technologique dans l'entreprise . Cependant, la technologie est une condition nécessaire mais pas suffisante pour garantir le dynamisme et la compétitivité des sociétés.

- Toute technologie nouvelle s'insert dans des technologies existantes qui ont déjà leur propre logique, leur propre dynamique, leurs propres contraintes. Dans l'entreprise, la **technologie a une histoire** ; elle n'apparaît jamais sans conditions particulières de management.
- La technologie détermine autant qu'elle est déterminée par des **relations manageriales** particulières : une organisation du travail , des conditions du travail , des dynamiques d'efficacité, de contraintes et de coûts.
- La technologie, parce que directement liée au mouvement de la science et de la connaissance présente des **effets externes positifs** (coûts et opportunités). C'est-à-dire que les dépenses et les efforts occasionnés à propos de projets précis présentent des avantages supérieurs aux coûts sur l'ensemble de la société.

Ces trois remarques soulignent que les relations entre **Science, Technologie , croissance d'entreprise, développement et progrès** n'ont aucun caractère automatique. Les liens sont très forts entre les uns et les autres, mais, le passage de l'un à l'autre n'a rien d'évident.
D'un côté, nous devons garder à l'esprit , l'**absence de neutralité de la technique** et les multiples détournements dont elle peut être objet , de l'autre, nous devons savoir qu'il existe davantage de technologies opératoires dans les tiroirs que de technologies mises en pratique. Ces **technologies gelées** ont une signification.

Il faut donc apprendre à **gérer les choix technologiques,** c'est-à-dire :

☐ d'abord **maîtriser les technologies** elles-mêmes.

☐ Ensuite connaître les **mécanismes** généraux de l'**innovation,** et de la gestion de la technologie **au sein des entreprises industrielles.**

□ Enfin avoir une connaissance minimale **des mécanismes organisationnels et financiers** permettant :

- d'évaluer les projets industriels à fort contenu technologique - de concevoir et d'appliquer des politiques de Recherche-Développement, de conception, de production et de marketing de nouveaux projets - d'articuler ces stratégies avec celles à développer vis à vis des partenaires de l'entreprise : fournisseurs, clients concurrents réels et potentiels mais, également, institutions financières et structures administratives et politiques.

Il s'en suit que notre projet doit conduire, d'un côté, à une formation opérationnelle d'ingénieurs-économistes susceptibles d'être employés dans des grandes organisations pour résoudre les problèmes indiqués ci-dessus ; il doit, tout autant, conduire à une formation davantage tournée vers la recherche sur la formulation des choix technologiques. L'UTC doit abriter simultanément un ensemble de recherches doctorales dans ces domaines différents. Cette formation est nécessairement pluridisciplinaire. Elle allie les domaines de génie industriel de l'UTC (Génie Mécanique, Génie Chimique, Génie Informatique et Génie Biologique) à ceux de la gestion des organisations, de l'économie, de la sociologie, des sciences politiques, des sciences cognitives, des langues, et des cultures.

## LE PROJET :

Pour compléter notre dispositif dans ce domaine, nous mettons actuellement en place un **Groupe de Recherche sur la maîtrise des choix technologiques** qui a pour mission de développer une compétence pluridisciplinaire en matière de maîtrise du progrès technique et des choix d'innovation, de maîtrise du transfert de la technologie, ainsi que de politique scientifique. Ces recherches s'orientent autour de 3 axes :

- l'entreprise
- son environnement
- les relations entre l'entreprise et son environnement.

La mise en oeuvre de programmes de recherche dans un domaine aussi vaste sera naturellement progressive. Les premières pistes seront déterminées par les demandes explicitement manifestées par les partenaires du projet, internes ou externes à l'UTC, en particulier les

partenaires industriels et l'ANRT, par les aptitudes des membres de l'équipe de recherche et par les participations des quatre autres départements de l'UTC. Ces recherches auront donc une double orientation : théorique et concrète, et un triple débouché : l'enseignement, l'expertise et la formation continue.

**□ Maîtrise de la technologie dans l'entreprise :**

- Histoire des choix technologiques dans les industries mécaniques,
- Histoire des choix technologiques dans les industries biologiques,
- Histoire des choix technologiques dans les industries informatiques,
- Histoire des choix technologiques dans les industries chimiques,
- Adaptation du personnel et changements technologiques,
- Financement de la technologie (capital-risque),
- Les marchés de la technologie-conseils, savoir-faire et transferts,
- Intégration du progrès technique par les PME,
- Statégies technologiques des entreprises dans des secteurs spécifiques (aéronautique, espace, agroalimentaire),
- Techniques d'analyse et de décision, modèles stratégiques ; technologie et réseaux, organisation industrielle,
- Normes et propriété industrielle,
- Analyse du risque technologique et des résultats,
- Evaluation des projets.
- La productivité,
- Théorie du progès technique et processus d'innovation technologique,

**□ Maîtrise publique de la technologie :**

- Politique de la Science et de la Recherche en France,
- Politique technologique Europeenne (CEE),
- Processus de prise de décision en matière de politique technologique,
- Evaluation comparative des politiques technologiques des partenaires internationaux,
- Politique publique des normes (interface des aspects technologiques, politiques et économiques),
- Recherche publique et enseignement.
- Infrastructures technologiques aménagées par les services publics (politique des technopoles et des télépoints).

**□ Interface**

- Transferts de technologie et coopération , conflit public -privé (sous-traitance, partenariat...),
- Transferts de technologie grandes entreprises - PME,
- Transferts de technologie Pays développés-Pays en voie de développement

- Transferts de technologie Pays développés - Pays développés,
- Liaisons Recherche & Développement/Université-Industrie,
- La prise de décision stratégique en milieu international,
- Méthodologie de la valorisation de l'innovation
- Atlas stratégique des technologies,
- Systèmes de développements techniques comparés,
- Stratégies des acteurs du transfert de technologie,
- Technologie et compétitivité mondiale.

**LE PROGRAMME :**

Le délai de mise en place du programme de recherche est de 3 ans.

• **PREMIERE ANNEE** (Nov 1988-Juillet 1989)

☐ Mise en place d'un **cycle de conférences** destinées à l'acquisition d'une culture collective. Celles-ci sont animées chaque fois par des chercheurs invités, appartenant aux principaux centres de recherche dans le domaine, en France (Strasbourg, Lyon, Nice, Grenoble, Ecole Centrale, Arts et Métiers) et à l'étranger ( Louvain, Montréal, Milan). Ce séminaire a débuté le 13 Janvier 1989 et a lieu tous les mois ; il durera exceptionnellement cette année toute la journée.

Thème des premiéres conférences :

*La constitution d'une économie de l'industrie*
*La France lache pied dans la course poursuite technologique*
*Recherche et développement, production et protection de l'innnovation*
*Le rôle de l'Etat dans le développement technologique international*

☐ Organisation de **séances de travail restreintes** avec des chercheurs de l'UTC et de l'Université de Paris Nord qui effectuent leurs travaux sur les recherches engagées en 1988 -89.

Ces séances ont pour objet l'examen détaillé des recherches en cours ainsi que leur confrontation avec les domaines de compétence et les besoins de l'UTC. La première journée de travail a eu lieu en Décembre 1988.

**Thémes de recherche engagés à ce jour**

- *La maîtrise du progrès technique dans les PME,*
- *Méthodologie de valorisation de l'innovation.*
- *Théorie du progrès technique,*
- *Les politiques technologiques de la Grande Bretagne,*
- *Les politiques technologiques de l'Italie,*
- *Les politiques technologiques Lander allemands*
- *Commandes publiques, progrès technique et croissance industrielle,*
- *Grands investissements*

.../...

□ Renforcement des **programmes pédagogiques** existants en gestion, en économie, et incluant le Mineur Technologie et Développement International des Entreprises et le programme FACE ( Formation Au Commerce Extérieur) avec l'élaboration d'études de cas.

□ Participation active à la production, l'édition et la diffusion de **"Cahiers du partenariat"**, revue mensuelle sur les initiatives privées-public de développement industriel régional et international.

□ Constitution d'un **comité scientifique de suivi** représentant les différents partenaires du projet.

## • DEUXIEME ANNEE :

La seconde année poursuivra, en les renforçant, les activités de la première année. Elle conduira en particulier à la mise en place de **recherches longues**, coordonnées entre elles (à l'image de l'expérience en cours sur la question des politiques technologiques comparées).
Ces travaux conduiront à des **publications** et à la **participation à des colloques**, en particulier à celui organisé par un GRECO du CNRS sur "la maîtrise sociale de la technologie" à l'automne 1989 : animation des ateliers "politique technologique" et "enseignement et management de la technologie".
Outre les activités de recherche, nous prévoyons de créer pour la rentrée 1989-1990, **un cycle de formation doctorale** sur le thème du Management de la Technologie. Ce cycle s'adressera simultanément à des gestionnaires et à des ingénieurs ayant achevé une formation supérieure complète (Bac +5). Il sera destiné à la formation de cadres s'orientant soit vers la planification d'entreprise, soit vers les services publics et bancaires soit vers la recherche. La forme institutionnelle envisagée pour le diplôme correspondant n'est pas encore arrêtée.
Cet enseignement aura à son tour pour effet d'initier de nouvelles recherches interdisciplinaires. Il donnera , en particulier, lieu à une **réflexion** méthodique sur les **questions pédagogiques** et, plus largement, sur le statut de la connaissance (Sciences technologiques pour gestionnaires et sciences du management pour ingénieur). Ces réflexions auront, au premier chef, des retombées dans le domaine des 1er et 2ème cycles de la formation d'ingénieurs à l'UTC.

.../...

## • TROISIEME ANNEE :

Elle devrait permettre le démarrage de recherches nouvelles résultant des travaux actuellement en cours et des nouveaux thèmes issus du cycle de formation doctorale.
Un service d'études et de conseil pourra également être assuré dans le prolongement des recherches engagées et pour répondre à des demandes particulières d'entreprises, notamment en liaison avec l'ANRT ou d'organismes publics, en liaison avec les entreprises GRADIENT et DIVERGENT et les activités de pépinière et de capital-risque qui se développent à Compiègne.

L'équipe invitée à participer et à développer ce programme est en cours de constitution. Elle pourrait atteindre une douzaine de personnes à la fin de la présente année universitaire mais devra nécessairement croître rapidement.

TSH-LV-BB-MR Mars 1989

UNIVERSITE DE TECHNOLOGIE DE COMPIEGNE

1989-1990

Programme
au 28 novembre 1989

## CYCLE DE CONFERENCES

# MAITRISE DES CHOIX TECHNOLOGIQUES

Bertrand BELLON - Jean ESMEIN

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Lieu : UTC Centre Benjamin Franklin
Salle C 216
de 9H30 à 17H30

**Mercredi 6 décembre 1989**

Bertrand BELLON :

1) Stratégies industrielles.
2) Place de la maîtrise des choix technologiques dans les stratégies.
3) La question des transferts de technologie
4) Mise en place du travail collectif pour l'écriture du "glossaire".

**Mercredi 10 janvier 1990**

Gérard POGOREL (ENST) *"Comparaisons internationales des structures pour la valorisation des technologies dans les entreprises"*

Expert du Centre de l'Energie Atomique. (à préciser)

.../...

**Mercredi 7 mars 1990**

Christian DU TERTRE (Université de Paris IX). "*La flexibilité technique et la flexibilité organisationnelle*".

Paul MAITRE (INSTN) et Thomas DURAND : "*La valorisation de la recherche*"

**Mercredi 4 avril 1990**

Jacques PERRIN (Université de Grenoble) :" *Les systèmes techniques*"
Olivier WEINSTEIN (Université de Lille) : thème à déterminer

**Mercredi 2 mai 1990**

Monsieur CASTAGNE (INPL Nancy)

**Mercredi 6 juin 1990**

Jean-Luc GAFFARD ( LATAPES, Université de Nice).

UNIVERSITE DE TECHNOLOGIE DE COMPIEGNE

1989-1990

Université de Paris-Nord
UFR de Sciences et Economie
et de Sc. de gestion

# COURS DOCTORAL

# D'ECONOMIE INDUSTRIELLE

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Bertrand BELLON

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Lieu : UTC, Centre Benjamin Franklin,
Salle C 216
de 9H30 - 13Heures
avec réunion de recherche (et/ou d'administration) l'après-midi.

**Jeudi 9 novembre 1989**

*Les oligopoles de ressources* (par Jean François LEMAITRE, Université de Paris X).

**Jeudi 14 décembre 1989**

*Concurrence imparfaite et économie internationale* (par Philippe BARBET, Université de Paris XIII).

**Mercredi 24 janvier 1990** (réservé)

**Mercredi 14 mars 1990**

*L'économie de la régulation* par Robert DELORME, Université de Paris XIII).