

Global generation of technology :
an evolutionary perspective

Catherine MERMOSZ

Communication to

European Meeting on Applied Evolutionary Economics

7 - 9 June 1999, Grenoble, France

Organised by the Institute for Energy Politics and Economics
Organisé par l'Institut d'Economie et de Politique de l'Energie /
IEPE, BP 47, 38040 Grenoble Cedex 9, France

And the INRA-Unit of Sociology and Economics of Research and Development
Et l'unité Sociologie et Economie de la Recherche Développement de l'INRA
INRA/SERD, BP 47, 38040 Grenoble Cedex 9, France

"European Meeting on Applied Evolutionary Economics"

IEPE - INRA - SERD

Grenoble

7 - 9 juin 1999

Global generation of technology :
an evolutionary perspective

Catherine MERMOZ

Docteur

CREREG (UMR CNRS 6585)

- Université de Rennes 1 -

Draft

Comments welcome

Tél. 04.72.71.88.65 - E-mail : catherinemermoz@minitel.net

Abstract

The global generation of technology fit with a new organisation in the way multinational firms innovate. They establish innovation projects where subsidiaries play a significant part. Previously, parent-company created innovation and then it was diffused to subsidiaries. Now innovation is generated by the parent-company and subsidiaries at once.

The global generation of technology refers to multinational corporations which are increasing the international integration of their R&D and technological activities. Multinational firms develop firm-based strategies in research and technology across different countries for generating innovations through the development of global research networks.

Previously, according R. Vernon's pattern (1966), innovations were conceived by the parent-company and only then diffused to subsidiaries. Nowadays subsidiaries play an active part in innovation generation. Parent companies are aware of subsidiaries' resource potentialities and subsidiaries' creativity which could be crucial to use for winning technological race. In that way diversity contains in multinational firms is a great source for innovation. Nevertheless diversity integration depends on learning capacity of the partners belonging to the innovation project.

Whereas interest in global generation of technology is shown by management analysis this paper contributes to justify the interest of such a way of innovating with evolutionary concepts because it is a new source of innovation very significant for winning technological race.

Introduction

Globalization of technology, and especially global generation of technology, is a new phenomenon which asks new questions about innovation. Indeed some innovation projects start to be implemented whereas partners are set up in different countries. This tendency exists between independent partners and, for instance, programs like those of European Union (RACE, SPIRIT, ...) are good examples of international partnerships although there are not the only ones. But this tendency also exists, and it is quite new, between multinational firms' parent-company and subsidiaries.

In an exacerbated technological race, parent companies become aware of subsidiaries' potential for generating innovation. Thus international development projects (IDPs) participate to global generation of technology tendency. In IDPs innovation is generated in partnership between several multinational firm subsidiaries and if necessary the parent company. This type of project has been first of all studied in management theories. Albeit that type of innovation generation could magnify co-ordination problems, in my opinion IDPs constitute a significant source of innovation and a trump for winning technological race.

Therefore this paper try to justify the interest of IDPs with evolutionary theory. Two features in IDPs seem significant, the diversity presents in multinational firm through several subsidiaries and organisational learning developed during innovation project. This two points will be developed in the second part of the paper because in the first part we presents globalization phenomenon.

I. From globalization to "international development projects"

Globalization : an overview

Since some fifteen years, globalization has become an outstanding phenomenon. Although it has been recently studied because of striking features, globalization has old roots.

Indeed, globalization is one of the "consequences of modernity" (A. Giddens, 1994). According to A. Giddens, roughly estimated, modernity refers to ways of life or to social organisations came into sight in the seventeenth century in Europe and that had a more or less ongoing effect on the whole planet. Nevertheless, one key feature of modernity is its dynamism. This dynamism is a consequence of the dissociation between time and space and to their recombining. This dissociation between time and space is higher than ever before and permits relationships between different social contexts or different areas. These relationships gradually generate a network overlaying the entire world. Thus globalization can be defined as intensification of the world-wide social relationships bringing nearer remote places to such a point that local events could be influenced by facts happening thousands of kilometres away. So globalization leads to the integration of dispersed geographic activities.

A. Giddens' definition of globalization is a general one which can be used by the all social sciences. A more restrictive approach is the one of the management theory with analysis of R. Ronstadt (1977), T. Levitt (1983) and C. Bartlett (1986). In their analysis globalization is one of the most important element of the general organisation of multinational firms. More precisely globalization is seen as a way of organising economic activities inside the multinational firm. So the stress is on the general evolution of the strategy and on the organisation of the multinational firms. Moreover new way for innovate inside multinational firms is one element of the globalization of technology.

Globalization of technology

The globalization of technology is a part of this general phenomenon. Globalization of technology changes the way by which multinational firms innovate. The simple scheme from centre to periphery has been modified for creating a more complex one. The sequential process, inherited from R. Vernon's product cycle theory (1966), which first of all generated technology in the centre and then spread and fitted it to the periphery has been superseded by a more complex one. Subsidiaries have improved their own R&D resources and managed research projects. The ongoing spread of R&D capabilities increases subsidiaries autonomy but at the same time technology complexity compels to create innovation in partnership. New types of complex configurations are generated in which subsidiaries have to achieve different

tasks. In that new context and as have shown G. Hedlund and J. Ridderstråle (1994), subsidiaries and R&D capabilities abroad have specific tasks and participate in international development projects.

To be more explicit we can now refer to the definition proposed D. Archibugi and J. Michie (1995). According to these authors globalization of technology has three meanings. It has been defined as the global exploitation of technology, the global technological collaboration and the global generation of technology.

Global diffusion of technology refers to international exchanges of high technology products. In 1970 exports of high technology products were about 12.2% of the whole exports of manufacturing products and 20.5% in 1989 (P. Guerrieri, C. Milana, 1995). Technology can equally be spread by sale of patents. Studying foreign patents D. Archibugi and J. Michie ascertain that 45% of patents taken out in USA originated from abroad. So global diffusion of technology have recently had a great increase.

Global technological collaboration refers to co-operations between partners from different country for developing new knowledge or innovation. In such a co-operation partners remain independent and could be government agencies, universities and firms. International co-operation between academic researchers doubles from 1974 to 1984 (J. Frame, F. Narin, 1988). And we know that co-operation between firms increased highly during the last decade and especially in high technology sectors. An American study has shown that the number of co-operations between an American partner and a partner from another country was about 90 per year in 1980 and 1500 in 1993 (W. Brown, J. Hirabayashi, 1996).

Global generation of technology is the last meaning for globalization of technology. This meaning is more restrictive than others because it refers to multinational firms only. Global generation of technology refers to internal networks within multinational firms. Units belonging to the network and having required competencies take part in innovation projects. Subsidiaries are no more simple adaptive units but become active units for accomplishing multinational firm's strategy. This process is really a new way of thinking subsidiaries' task in world-wide technological competition.

The last definition given to globalization of technology may be quite restrictive, but it is not so far from A. Giddens' general definition. Indeed according to A. Giddens globalization refers to the intensification of world-wide relationships which bring nearer remote places. In the case of the globalization of technology we have innovation projects between partners world-wide set up. Therefore what is done in one subsidiary or in one partner set up could have effects on other ones. In my opinion, the last meaning is the most interesting to study because it refers to multinational firms new strategy which run to new organisation for innovation generation. But before studying global generation of technology we would like to present few figures showing the significance of the globalization of technology.

Evaluation of globalization of technology

Global generation of technology could be seen as a consequence of the spread of multinational R&D capacity all over the world. Few studies have shown the importance of R&D capacity abroad.

A study is on the 500 greatest multinational firms of the world (M. Casson, R. Pearce, S. Singh, 1992). In 1989, 39% of the R&D laboratories in the USA were under control of a foreign firm and 31% of the US laboratories were set up abroad. All in all 39% of the multinational firms' laboratories were set up in a different country from the parent company.

According to a study of the Japan External Trade Organisation (JETRO, 1994), 36% of the Japanese firms set up in Europe have R&D capacities. Compared with the 1990 study, the number of R&D capacities has been multiplied by 3.7. R&D laboratory setting up in Europe is quite recent because 75% of them were set up between 1986 and 1993.

These few figures briefly show how multinational firms are committed in foreign countries for their research activities. This commitment has perceptibly been increased during the last decade. Then we can suppose that multinational firms found a benefit having research capacities all over the world. Several reasons could be expounded like, the presence of a helpful local scientific environment and adequate technical infrastructure or availability of

research professionals ... (R. Pearce, 1992), but in my opinion the most significant benefit is the set up of international development projects.

Global generation of technology

Given the existing technological race, firms should use the whole technological resources they have. According to C. Bartlett and S. Ghoshal (1992) multinational firm should make the best use of its resources valorising subsidiaries competencies and allowing them to have more autonomy. This change in multinational firms exists in the whole organisational functions and in R&D also. Therefore the setting of international development projects is done for using the best competencies available in subsidiaries. The aim of that type of projects is to generate innovation able to sustain competitive advantage of the firm.

Global generation of technology refers to innovation projects in which parent company and subsidiaries or subsidiaries alone co-operate. Its a peculiar co-operation because partners belong to the same group, to the same multinational firm. But it is really a co-operation because partners work together to achieve a common aim that is to say generate innovation.

G. Hedlund and J. Ridderstråle (1994) have studied international development projects (IDP). "*An IDP is a project aiming at the development of a specific product, for a wide international market, and involving strategic development resources in several countries*" (G. Hedlund, J. Ridderstråle, 1994, p. 5). This definition refers to international technological co-operation between parent company and subsidiaries which is a part of the globalization of technology and especially global generation of technology.

The objective of IDPs is to use different complementary but dispersed resources, and especially skills and knowledge, existing in parent company and subsidiaries to generate innovation. Innovating project members belong to several subsidiaries set up in different countries.

Three main advantages emerge from that type of project. Knowledge and skills have been increased and foreign skill contribution have run into technical solution of high quality. Diversity of the knowledge bases and differentiated approaches for solving problems have increased creativity. And finally, learning has been developed.

But that type of projects have equally disadvantages. The most significant are problems of communication and the increase of time necessary to solve problems involving over costs. Physical distance combined with cultural differences complicate co-ordination during the project. Nevertheless the international characteristic of the project has just an magnifying role. Problems exist in co-operation between partners belonging to the same national culture.

One the one hand IDPs are interesting because they illustrate what is global generation of technology and one the other hand they contain diversity and generate learning necessary for innovation. Let us examine diversity and learning questions in the next point.

II. Diversity and organisational learning : trumps for IDPs

Diversity

International development projects should be, for multinational firms, an important source of innovation because of subsidiaries' diversity.

Diversity is central in the evolutionary theory (Dosi and al., 1988 ; Dosi, 1988) because the diversity of a system affects its development. In economic systems peculiar mechanisms generate diversity, like technological innovations and economic competition which make a selection. These two mechanisms change the relative importance over time of the surviving diversity. Therefore innovation is not random but an integrated part of economic activity.

From the evolutionary point of view, variations within species become important. The diversity in production structure or in research structure is a source of information which can

be used in the innovation process. According to P. Cohendet, P. Llerena and A. Sorge (1991 ; p. 7), "*diversity drives evolution and evolution generates diversity*". Diversity refers to qualitative aspect of change which is an underlying principle for economic development. So technical change and innovation could be seen as a process of evolutionary change built on diversity and on a competitive selection. These authors assume "*that there are some local determinants in the process of creation/diffusion of technologies, which imply some degree of dependence of the innovation process on specific local context and external environment*" (p. 8).

Therefore, multinational subsidiaries could be understood as peculiar local contexts, local entities regarded as one of the basic element of global economic competition. Local entity is an active element which can create and select technologies in a specific manner. P. Cohendet, P. Llerena and A. Sorge (1991 ; p. 9) talk about creative advantages bound to local entity, in order to stress the potential of creative activity related to a local unit. Also multinational firms control a whole of local units generating a system of innovation capable to create advantages.

Beyond all doubt the diversity contains in multinational firms through numerous subsidiaries could be regarded as a significant competitive advantage. The knowledge base and the spectrum of learning activities are enlarged with respect to other types of firms. This enlargement of the base of knowledge allows to keep a maximum number of choices and confers to the multinational firm a better ability to react to environmental changes.

Diversity is very important whereas technology is at a start-up stage, when it is impossible to conceive any best use of the technology. Diversity has a specific value "*in the sense that different local experiments of the new technology could inform rapidly by varied processes of local trial and errors about the possible developments and practices of the new technology or on the contrary about some misuses or wrong conceptions*" (P. Cohendet, P. Llerena and A. Sorge, 1991 ; p. 25). Here P. Cohendet and al. talk about the generation of a new technology during the "pre-paradigmatic" stage. But we could think that in the case of international development projects the phenomenon is rather similar. Subsidiaries entrusted with the project have each other different peculiar experiences which allow them to have a technical

viewpoint on the ongoing innovation process. They could compare their experiences and knowledge trying to end at the best technological solution as they could.

Of course, the successful result depends on the ability to each subsidiaries involving in the project to transform some generic principles into specific knowledge through the "combination principle" (I. Nonaka and H. Takeuchi, 1997), and to transmit its own experience in terms of learning and creation to partners through the "exteriorisation principle" (I. Nonaka and H. Takeuchi, 1997). Therefore an interactive learning between the subsidiaries and an incentive to exchange information are necessary. Diversity has an interest only if there are learning processes to make use of it and unified it. Learning processes would be examined in the next paragraph.

Organisational learning

The analysis of the diversity could be extended by the analysis of learning during co-operation. In a varying economic environment in which product life cycle shortens, the key characteristic for firm being able to survive is the capacity of learning.

Thus N. Lazaric (1994) has shown that co-operation between two firms could be an important source for innovation through the combination of different backgrounds of knowledge. Her analysis is there a cognitive one. She is specially interested in the diversity of knowledge base belonging to two different firms. She examines how two separate knowledge bases could generate a new one. Then organisational learning becomes very important because of the confrontation of two different frameworks which generates a new knowledge combination. This new combination is therefore a source of innovation.

In a certain way, we could imagine that international development projects are something like a co-operation between several enterprises even though they belong to the same multinational firm. One subsidiary can be regarded as different from another because of its peculiar history and its specific technological trajectory and routines. The question is now to understand how learning let innovation generation.

Definition

Albeit learning is taken into account in the neo-classical theory, with for instance the work of K. Arrow (1962) about learning-by-doing, the concept refers more to cognitive theories like behaviourist, evolutionary or management approaches.

For behaviourist authors like R. Cyert and J. March (1963), organisational learning is an ongoing change of the firm aims which are dependent on past events and past routines. This dependence results from a correcting process between initial objectives and obtained results. Corrections, that is to say learning, can exist at several levels (C. Argyris and D. Schön, 1978). "Single loop learning" occurs when there is a change in the rule without implicating a global change in the firm objectives whereas "double loop learning" appears when corrections entail a change in underlying policy and objectives of the firm. At last, "deutero-learning" results from the move from single loop learning to double loop learning and permit to the firm to learn from the process of learning itself.

Therefore organisational learning has a cognitive dimension (N. Lazaric (1994), C. Tanguy (1996)). Organisational learning takes into account the collective process by which new competencies are built. This process permits to the firm to gain knowledge and specific skills and to build up a new productive capacity or a new collective knowledge. As innovation can be understood as a technology creation process (M. Amendola and J.L. Gaffard, 1988), organisational learning becomes an outstanding phenomenon.

This kind of approach provides to the firm a cognitive dimension. The firm is a central, albeit by no means unique, repository of technical knowledge (M. Cimoli and G. Dosi, 1994, p. 3). The firm is an organisation in possession of a collective knowledge embedded in the internal functioning rules. So when several firms participate to an innovation project either by a co-operation between independent partners or in an international development project, for generating an innovation a learning process must be set up.

Generation of a new organisational learning during an international development project

We will now examine how a new organisational learning could be set up during an international development project leading to innovation. Several conditions should be got together.

Corporate culture is at the root of organisational identity, cements individuals and mobilise common frameworks and shared theories of action. It can be defined as a cognitive map which includes shared sets of assumptions, beliefs and values held by an organisation. This organisational identity is dependent on the way knowledge is organised, structured and shared inside the firm (structure of the firm, ways of dividing work and co-ordinating decision problems, informational loops). Nevertheless, for the combination to be fruitful, corporate culture of the partners must be close enough.

According to N. Lazaric, the combination of knowledge can be very fruitful if it is not only an additional process but a fusion of several cognitive frameworks in order to generate a new one. At the same time, costs and gains from learning depend on the cultural distance existing between firms (B.A. Lundvall, B. Johnson, 1992). The more the knowledge basis are distant the more the potential gains from learning are significant. Nevertheless, a significant learning needs to have shared informations with the initial learning for creating common language and trust. This investment in communication will be greater when cultural distance is significant. Therefore gains from learning will be high when cultural distance is at intermediate level. In international development projects, we can estimate that the culture of the subsidiaries are different enough to be creative and close enough to efficiently communicate.

For knowledge bases to be combined in an efficient way it is important to take into consideration skills and knowledge existing for each firm. W. Cohen and D. Levinthal (1989) has shown that the "absorptive capacity" of a firm can estimate, absorb and integrate outside knowledge and skills. Learning is there dependent of the ability of the firms to integrate and to combine new knowledge.

In a certain way international development projects could be a good compromise generating innovation. Firms engaged in the project have their own culture because of their

history, their national roots, their internal organisation, ... but at the same time they share the corporate culture of the multinational to which they belong to. Communication and common cultural investments could be lower than in a traditional partnership.

According to N. Lazaric (1994), several means exist for co-ordinating diversity and specially diversity of cultures and knowledge bases. Those means are the rules, routines, conventions, common language and trust. Let briefly consider each of them.

Rules are important for the co-ordination of cognitive backgrounds of different firms. They make easy the work by mechanisms which save time in the case of repeated interactions.

Routines support the organisation's knowledge basis and they constitute the core organisational memory. The organisation implements a routine by using it like individuals implement their skills by using them. Routines refer to the organisation's repetitive pattern of activity. They represent a truce in the conflict between the constituent part of the organisation (R. Nelson and S. Winter, 1982). According to N. Lazaric (1995, p. 375), when co-operation exists since several years between the same partners, routines generated become more and more specific, difficult to change and it brings a significant degree of inertia. Therefore, in international development projects, it could important that partners participating in several projects will not be always the same avoiding a routinized behaviour.

Conventions are the third mean for co-ordinating diversity. Conventions are able to generate common knowledge, similar representations and promote their convergence. A convention is a regularity in a person's behaviour facing a co-ordination problem. In a certain way, conventions could be understand as the rules of the game and so they have an importance avoiding opportunist behaviours.

Common language is very important for avoiding misunderstandings resulting from different corporate cultures. According to N. Lazaric, if a common language is not set up, trust is not possible between partners but it is seldom the case. Common language is especially built between people of the same professional culture and can transcend cultural distance. As J. Ridderstråle (1996) has shown troubles during international development projects occur

between people from different function (R&D vs. production, or marketing vs. R&D) irrespective of national culture.

Last but not least, trust is an important asset against uncertainty. It is generated through a learning process and thus it becomes highly specific and difficult to transfer. Trust is very significant for reducing cultural distance between two firms and it could be linked with common language, common language participating to trust construction.

Conclusion

Changes in the way multinational firms innovate are especially studied by management approaches. Nevertheless evolutionary approach could equally help understanding why new type of organisation in innovation process could be interesting in an exacerbated technological race.

So global generation of technology is a trump for multinational firms because they hold, through subsidiaries, diversity necessary for innovation. But as we noticed, diversity and especially knowledge base diversity, has an interest only if learning processes exist to make use of it and unified it. Several means exist for co-ordinating diversity like rules, routines, conventions, common language and trust. Multinational firms could have an advantage with respect to other firms which innovate in partnership because of the more or less common rules and conventions which can be more homogeneous although different.

This paper is a first draft and comments will be welcome.

- AMENDOLA, M., GAFFARD, J.L. (1988)**, *La dynamique économique de l'innovation*, Economica, Paris, 161 pages.
- ARCHIBUGI, D., MICHIE, J. (1995)**, "The Globalisation of Technology : A New Taxonomy", *Cambridge Journal of Economics*, vol. 19, n° 1 pp. 121-140.
- ARGIRIS, C., SCHÖN, D. (1978)**, *Organizational Learning : A Theory of Action Perspective*, Addison Wesley Publishing Company, Reading Mass., 344 pages.
- ARROW, K. (1962)**, "The Economic Implication of Learning by Doing", *Review of Economic Studies*, n° 29, juin, pp. 155-173.
- BARTLETT, C. (1986)**, "Building and Managing the Transnational Corporation : The New Organization Challenge", in **M. PORTER (ed.)**, *Competition in Global Industries*, Harvard Business School Press, Boston, Mass., pp. 367-401.
- BARTLETT, C., GHOSHAL, S. (1992)**, *Transnational Management : Text, Cases, and Readings in Cross-Border Management*, International Student Editions, Boston, 914 pages.
- BARTLETT, C., DOZ, Y., HEDLUND, G., (eds.) (1990)**, *Managing the Global Firm*, Routledge, London, 363 pages.
- BROWN, W., HIRABAYASHI, J. (1996)**, "Brevets à plusieurs inventeurs résidant dans différents pays", in O.C.D.E., *Innovation, brevets et stratégies technologiques*, Paris, pp. 257-291.
- CASSON, M., PEARCE, R., SINGH, S. (1992)**, "Global Integration Through the Decentralisation of R&D", in **M. CASSON (ed.)**, *International Business and Global Integration*, The Macmillan Press LTD, London, pp. 163-204.
- CIMOLI, M., DOSI, G. (1994)**, "Technological Paradigms, Patterns of Learning and Development, An Introductory Roadmap", *Working Paper*, International Institute for Applied Systems Analysis, Laxenburg, Austria, WP-94-83, 38 pages.
- COHEN, W., LEVINTHAL, D. (1989)**, "Innovation and Learning : The Two Faces of R&D", *The Economic Journal*, 99, pp. 569-596.
- COHENDET, P., LLERENA, P., MARENGO, L. (1995)**, "Learning and organizational structure in evolutionary models of the firm", Communication au colloque *Innovations technologiques et performances : approches interdisciplinaires*, CNRS, Paris, 22 mars, 18 pages.
- COHENDET, P., LLERENA, P., SORGE, A. (1991)**, "Modes of Usage and Diffusion of Science and Technology - Valorizing Diversity", Paper presented at the *International Symposium Europe - USA : Management of Technology*, Paris, May 27-28, 32 pages.
- CREMER, J. (1990)**, "Common Knowledge and the Co-ordination of Economic Activities", in **M. AOKI, B. GUSTAFSSON, O. WILLIAMSON (eds.)**, *The Firm as a Nexus of Treaties*, Sage Publication, London, pp. 53-76.
- CYERT, R., MARCH, J. (1970)**, *Processus de décision dans l'entreprise*, Dunod, Paris, traduit de *A Behavioral Theory of the Firm*, Englewood Cliffs, Prentice-Hall, New Jersey, 1963.
- DE LA VILLE, V.I. (1998)**, "L'apprentissage organisationnel : perspectives théoriques", *Les Cahiers Français*, n° 287, juil-sept., pp. 96-104.

- DOSI, G. (1988)**, "Sources, Procedures and Microeconomic Effects of Innovation", *Journal of Economic Literature*, vol. XXVI, pp. 1120-1171.
- DOSI, G., FREEMAN, C., NELSON, R., SILVERBERG, G., SOETE, L. (eds.) (1988)**, *Technical Change and Economic Theory*, Pinter Publishers, London, 646 pages.
- FRAME, J.D., NARIN, F. (1988)**, "The National Self-Preoccupation of American Scientists : An Empirical View", *Research Policy*, vol. 17, pp. 203-212.
- GIDDENS, A. (1994)**, *Les conséquences de la modernité*, L'Harmattan, Paris, 192 pages, traduit de *The Consequences of Modernity*, Policy Press in association with Basil Blackwell, Cambridge, 1990.
- GUERRIERI, P., MILANA, C. (1995)**, "Changes and Trends in the World Trade in High-Technology Products", *Cambridge Journal of Economics*, vol.°19, n° 1, pp. 225-242.
- HEDLUND, G., RIDDERSTRÅLE, J. (1994)**, "International Development Projects : Key to Competitiveness, Impossible, or Mismanaged ?", *Working Paper*, Institute of International Business, Stockholm, 28 pages.
- HEDLUND, G., RIDDERSTRÅLE, J. (1994)**, "International Development Projects : Characteristics, Communication Patterns, Problems and Performance", *Working Paper*, Institute of International Business, Stockholm, 30 pages.
- JAPAN EXTERNAL TRADE ORGANIZATION (JETRO) (1994)**, *The 10th Survey of European Operations of Japanese Companies in the Manufacturing Sector*, october, 199 pages.
- LE BAS, C. (1993)**, "La firme et la nature de l'apprentissage", *Economies et Sociétés, Série Dynamique technologique et organisation*, n° 1, 5/1993, pp. 7-24.
- LE BAS, C., ZUSCOVITCH, E. (1993)**, "Apprentissage technologique et organisation", *Economies et Sociétés, Série Dynamique technologique et organisation*, n° 1, 5/1993, pp. 153-195.
- LAZARIC, N. (1994)**, "Organizational Learning during Technological Cooperation : Theoretical Discussion and some Empirical Evidence", Communication au colloque EUNETIC, *Evolutionary Economics of Technological Change : Assessment of Results and New Frontiers*, European Parliament, Strasbourg, October 6-7-8, 24 pages.
- LAZARIC, N., MONNIER J.M. (eds.) (1995)**, *Coordination économique et apprentissage des firmes*, Economica, Paris, 251 pages.
- LEVITT, T. (1983)**, "The Globalization of Markets", *Harvard Business Review*, may-june, pp. 92-102.
- LUNDVALL, B.A., JOHNSON, B. (1992)**, "Closing the Institutional Gap ?", *Revue d'Economie Industrielle*, 1er trimestre, n° 59, pp. 111-123.
- MERMOZ, C. (1999)**, *Systèmes localisés d'innovation et globalisation de la technologie*, thèse de doctorat, CREREG, Rennes, janvier, 250 pages.
- NONAKA, I., TAKEUCHI, H. (1997)**, *La connaissance créatrice*, De Boeck Université, Paris, Bruxelles, 303 pages.
- PEARCE, R. (1992)**, "Factors Influencing the Internationalization of Research and Development in Multinational Enterprises", in **P. BUCKLEY, M. CASSON (eds.)**, *Multinational Enterprises in the World Economy*, Edward Elgar, London, pp. 75-95.

- REDDY, P., SIGURDSON, J. (1994)**, "Emerging Patterns of Globalisation of Corporate R&D and Scope for Innovative Capability Building in Developing Countries ?", *Science and Public Policy*, vol. 21, n° 5, pp. 283-294.
- RIDDERSTRÅLE, J. (1996)**, *Global Innovation - Managing International Innovation Projects at ABB and Electrolux*, Institute of International Business, Stockholm School of Economics, Stockholm, 420 pages.
- RONSTADT, R. (1977)**, *Research and Development Abroad by U.S. Multinationals*, Praeger, New York, 127 pages.
- SIMON, H. (1947)**, *Administrative Behavior, A Story of Decision. Making Processes in Business Organization*, 2d ed. 1961, The Macmillan Company, New York, 259 pages.
- TANGUY, C. (1996)**, *Apprentissage et innovation dans la firme : La question de la modification des routines organisationnelle*, thèse de doctorat, CERETIM, Rennes, décembre, 383 pages.
- THE CONFERENCE BOARD, (1995)**, *The Changing Global Role of the Research and Development Function*, report n° 1123-95-RR, 34 pages.
- VERNON, R. (1966)**, "International Investment and International Trade in the Product Cycle", *Quarterly Journal of Economics*, may, vol. 87, n° 2, pp. 190-207.