



UNITED NATIONS
ECONOMIC
AND
SOCIAL COUNCIL



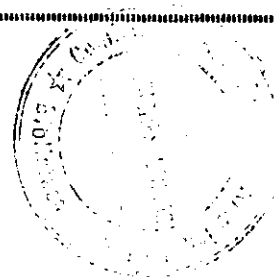
LIMITED

02

E/CEPAL/L.126
28 October 1975

ORIGINAL: ENGLISH

ECONOMIC COMMISSION FOR LATIN AMERICA



PROBLEMS RELATED TO INTERNATIONAL TRANSFER OF TECHNOLOGY:
THE EXPERIENCE OF LATIN AMERICA AND SIMILARITIES
TO THAT OF WESTERN PACIFIC COUNTRIES

by

Win Crowther

Mr. Crowther is Acting Director of the Latin American Centre for Economic and Social Documentation (CLADES) and Adviser to the ECLA Transport and Communications Division. The opinions expressed in this study are the exclusive responsibility of the author and may not coincide with those of the organization to which he belongs.

75-10-2107-270

2000

2000

2000

2000

2000

Problems related to international transfer of technology:
the experience of Latin America and similarities to that
of Western Pacific countries

The purposes of this presentation are (i) to describe briefly the present capacity of Latin America to assume an autonomous, constructive and viable position in the selection and negotiation of technology transfers, including certain very positive and exciting trends in this regard; (ii) to posit several hypotheses for a dynamic model of technological development and its diffusion in Latin America, based on recent empirical studies, which are suggestive of key factors which need priority attention; and (iii) to suggest ways in which the experience of the Western Pacific countries regarding technological change and its implications for socio-economic development could be usefully studied by the Latin American countries, which in turn could offer important concepts and interesting technological ideas to the Western Pacific countries.

A. Assumptions

The basic premise of this presentation is that an autonomous, positive and viable position of a developing country regarding technological transfers is one that attempts to achieve the following:

- (1) The capacity to identify and translate the country's major socio-economic problems and possibilities into a coherent set of technological requirements, and to evaluate and prepare the technical and human resources of the country to meet these requirements, so that technology transfers are made mainly to help develop these resources, to cover unavoidable deficiencies of resources or in an exchange of technologies based on comparative economic costs.
- (2) The recognition and promotion of the capacity to innovate, to implement innovations and deal with their effects, with

/ample planning

ample planning and consideration for the socio-economic realities of the country.

- (3) The analysis of the separate hardware and software components of technological packages, and the capacity to negotiate for only those components, on reasonable terms, that are deemed necessary.
- (4) Awareness of the ideological content of technologies and technical decisions, recognizing that the importance of technology is not related to its supposedly imperative nature, which is a myth, but rather to its pedagogical value as it draws us from the known and perceived towards the infinite, and thus that great care is needed not to fall in the mistake of accepting pre-defined technological packages or professional paradigms.

B. The earlier versions of the "science and technology infrastructure" strategy

The literature on technological development and dependence produced in Latin America during the last decade indicates considerable and increasing preoccupation with the types of problems cited above. During the mid-1960's, much was written about the need to develop the negotiating power of the Latin American countries in order to alleviate the conditions of purchase of technologies; to analyze technological packages in terms of their components; to build up research and development (R & D) in industries and in specialized technological institutes; and to set out legislation to regulate the introduction of inappropriate technologies or of technologies at unreasonable costs. The emphasis was on the development in each Latin American country, particularly the larger ones, of a "science and technology infrastructure", especially by reinforcing the applied research activities of certain professional groups, such as engineers; by centralizing the regulation of specific governmental activities related to technological transfers and technical assistance; and by

/providing new

providing new or more dynamic services of research, technical norms, quality controls, market information and information on technological options, particularly to industries 1/. By the end of the 1960's, it became more apparent that such activities, in order to be effective, particularly for the smaller countries of the region, required subregional or regional action, and Decision 24 of the Andean Group was approved in 1970 with clauses relating to technological transfers, which put the theory of dependence in a position of trying to catch up with remedial measures being put into practice 2/.

National "science and technology infrastructures" were designed and their different elements created at different rhythms, primarily depending on the political astuteness and force of one or another professional group in each country to identify itself with this new symbol of development and to carry out a process of institutional development favorable to that profession's own objectives.

The "infrastructure" may be summarized in terms of three levels of basic decisions and twelve elements intended to give the needed support on technological matters to these decisions, as shown in Table I. The most specific or basic, level of decisions involves the programming and administration of production and services. Especially important among such decisions are those regarding (i) investments, (ii) the selection and adaptation of technologies, (iii) the needs for technical assistance, (iv) the conditions that will be accepted on the purchase or transfer of technologies or on technical assistance, (v) organizational and information system development, and (vi) levels of production and services, including the part of these that will be exported. Normally these decisions are made at the enterprise (public, mixed or private) level, but in certain places or circumstances they are made at the Ministerial level.

Another level of decisions includes the plans, policies and controls on technological decisions set out by the governments as normative directives or guidelines. National councils on science and technology (the CONICYTs), the planning institutes and other high level public organizations elaborate and apply these norms.

A more general level of decisions refers to the national development plans, including sectorial plans.

TABLE I

Technological decisions and infrastructure

<u>Elements of technological support</u>	<u>Basic decisions</u>	<u>Elements of technological support</u>
A. Conceptualizations of the factors that lead to technological development or dependence -	1. National development plans, including sectorial plans	G. Technical assistance
B. Case studies of technological development	2. Normative directives and guidelines in the form of technological development plans, policies and controls	H. Criteria for development of technological infrastructure and information systems
C. Research and development (R & D)	3. Decisions on programming and administration of production and services:	I. Difusion of information
D. Education and training of professionals, scientists and technicians.	(1) Investments	J. Technical standards and quality controls
E. Consulting	(2) Selection and adaptation of technologies	K. Patents and industrial property
F. Professional associations	(3) Needs for technical assistance	L. Financing of technological development
	(4) Conditions accepted on purchases of new technologies or on technical assistance	
	(5) Organizational and information system development	
	(6) Levels of production and services	

The strategy of developing national "science and technology infrastructures" has not led to the desired results, although one could argue that the effort was quite useful and important. At the general level of criticism, the strategy appears to have changed the nature of technological dependence without really reducing it very markedly. Also, it appears to have concentrated on producing a new intellectual and policy "infrastructure" without altering the basic aspects of technological underdevelopment which exists at the level of programming and administration of production and services. These general criticisms can be broken down into the following more specific ones:

- (a) Rather than an orderly and logically sequential development of the twelve elements of technological support, actions in this regard have been imbalanced and uncoordinated, reflecting a certain amount of competition among institutions for a share of the benefits which accrue to those which identify with the "science and technology infrastructure". The case of Peru is exceptionally positive in this regard, with the combination of many of the activities of support in a single organization, which is presently undergoing a geographic decentralization 3/.
- (b) The effectiveness of institutional developments with regard to any particular element of technological support has been limited by the continuing underdevelopment or dependent orientation of other elements, putting the industrialist, exporter or public enterprise manager in the middle of cross pressures regarding the criteria for his selection of technologies, investments, or other decisions.
- (c) In some countries, the new elements of support have helped or regulated only some sectors, chosen not so much for their importance to the economy or for technological development as for their interest in or susceptibility to controls.
- (d) In some cases, the development of institutions to foster and administrate the elements of technological support has led to the reinforcement of professional paradigms 4/, and thus to less criticism of the models of professional activity which are imported by means of textbooks, technical assistance, international organizations, financial pressures and returning students. This is especially the case when these institutions become the domain of a single professional viewpoint, or form a stable link to a foreign "sponsoring" institution.

/(e) The lack

- (e) The lack of relation between the directives or guidelines for technological decisions (the second level), often elaborated by scientists or engineers, and the development plans (the first level of decisions), often elaborated by economists, has been cited often in recent critiques.
- (f) There has been insufficient study or awareness of the long history of attempts in Latin America to sustain the development of a "science and technology infrastructure", and of the divergent attitudes among professionals and technicians in the region towards the proper methods of inducing technological development. The search for an autonomous, positive and viable technological policy is not new, and various different strategies have been attempted with very different results. One study of attempts to develop an "infrastructure" during the last 100 years in the field of civil engineering in Chile concludes that previous failures were not so much due to the changes in policy or governments, but rather due to other elements: the occasional introduction of massive technical assistance with a point of view that set back an ongoing process by which the Chileans themselves had been modifying and adapting technological models more to national needs and realities; or the sudden rise in power in the public administration of a group of Chileans intent on implementing the momentarily accepted paradigm of their profession, replacing other groups which favoured other methods of technological development 5/.
- (g) There has been a presumption that politics and technology should be separated as much as possible, in order that serious independent research is possible, instead of recognizing the value of "politics" as a corrective mechanism to force research and the preparation of technological guidelines to maintain relevance for the society's problems. Naturally, both political bargaining and technological decisions are susceptible to losing contact with socio-economic realities, and both are needed to check on this danger in the other. At least in the case of political bargaining, there is explicit awareness of the "representative" function that politics should have with regard to the society's problems. Technological decisions should also be made with explicit awareness that a particular market or a particular "constituency" (often called "users," "beneficiaries", or "subjects") is favoured by the solutions which are offered.

/(h) There has

- (h) There has been a strong preoccupation with the production, rather than the productivity (or relevance) of science and technology. More research and development (R & D) were considered inherently better, irrespective of the social costs or benefits to be derived 6/.
- (i) Other difficulties relate to tactical problems of implementation of the strategy, with cases of excessive reliance on juridical solutions, broad policy guidelines and the attempt to impose norms rather than engage in dialogues with those who are most directly responsible for the programming and administration of production and services.

The strategy of regionalizing the "science and technology infrastructures" has also met with unexpected problems, although it is a strategy which has hardly been explored or tried extensively enough. There are three inter-related problems with regionalization that need to be analyzed further:

- (a) There is a lack of institutionalization and communication at the regional level with regard to many of the elements of technological support. There are exceptions. The technical norms' institutes are joined in COPANT, the Comité Panamericano de Normas Técnicas, which is now seeking to improve the communication links among its member institutions. The civil engineers of Latin America have organized well at the regional level to study the role of their profession in technological development. The development banks are comparing their criteria and decision-making procedures through ALIDE, the Asociación Latinoamericana de Instituciones Financieras de Desarrollo. In some cases, the communication among institutions carrying out similar functions in different Latin American countries, is quite accidental, personal or rather limited to a small rather closed group.
- (b) The problem of poor communication is due in part to insufficient attention to the problem of technological information. Only recently have overall studies and implementation of national technological information systems been undertaken, examples being Bolivia and Colombia. There are some quite sophisticated specialized documentation centres in the region, but these tend to be primarily outlets of international systems, and are

/relatively poor

relatively poor at recovering the materials and innovations produced in the region and at relating the information which is received to the pressing socio-economic problems of the region. Other centres develop to meet an immediate local need for information, and are not in conditions for an efficient exchange of information on a regional or international basis. The techniques of satisfying both relevance and interchange have not been duly explored or experimented.

Information with regard to some data, or to each element of technological support, is classified and interchanged in an independent manner, ignoring the need of the user for easy retrieval of an overall "profile" of the technology he is interested in. Lack of such profiles also severely limits the possibilities of implementing subregional decisions on policies and controls on technology transfers.

- (c) The problem of poor communication within the region means that the region's influence on the international process of recognizing and defining new technologies is much less than that justified by the quality and quantity of its own human and technical resources. The region's production-line innovations are relatively unknown. The region has limited influence on the setting of international technical norms. International organizations underrate the potential in the region to generate consulting activities, for projects inside and outside of the region. The concepts of technological development and dependence which originate in the region, and which are potentially valuable for other regions, are poorly understood.

In part, the region's own institutions and professionals are at fault here. It is interesting to note that the major intellectual point of references regarding ideas, norms and rules-of-the-game for each of the twelve elements of technological support almost invariably are institutions based outside of the region. Examples are UNESCO and OAS regarding education and formation of professionals, World Bank regarding consultants, UNDP and UNCTAD regarding technical assistance, IDRC and UNDP regarding financing of technological development projects, and the University of Sussex regarding conceptualization of technological development and dependence problems. While each of these institutions is to be commended for its interest in

/the region,

the region, it is notable that the region's own experts, who have rightly insisted that the developing countries do have a separate reality and an important point of view, have not really formalized devices at the Latin American level for consolidating this point of view into one voice, but rather relate to each other largely through organizations which must be responsive to other perspectives as well.

The problems with the strategy of "science and technology infrastructure" reflect basic problems with the analyses that underlay the strategy. The analyses were generally based on rather static models of technological change, did not demonstrate logically that the strategy would really deal effectively with the set of problems that were identified, were oriented to the development and reinforcement of professional mores rather than to an explanation of what affects decision-making at the enterprise level, and too often assumed that technology could be treated as a new "field" rather than as a horizontal dimension of existing economic fields.

An important step forward to overcome these limitations of analysis and strategy was made by the Organization of American States with its Pilot Project on Technology Transfers (PPTT) 2/. This project was able to verify, in attempts to experiment with technology transfers, that there were problems of coordination and communication between the representatives of the national "science and technology infrastructure" (acting as "national focal points" for the project) and the enterprises or sectors. However, many of these problems were overcome in concrete cases of dialogue between these levels of decision during the project, especially as integration took place between the different approaches to motivating technological development (the "pull approach", the "push approach", focus on engineering and organization of sectorial action).

Apart from the development of "science and technology infrastructure" and the "defensive legislation" on the transfer of technology, the State in Latin America has not really exploited its major tools-at-hand for controlling and influencing decisions on technological transfers. This is most evident in the case of information systems and public enterprise activities.

As noted earlier, the problems and possibilities of technological information system development have received relatively little attention, even in projects that are quite comprehensive with regard to the other

/factors of.

factors of technological transfers and development. This is most surprising given that most Latin American governments have adopted policies of indirect rather than direct regulation of transfers of technology, and the effectiveness of such policies depend on clear and informed indications of technological options. Brazil, Chile, Mexico and Venezuela have innovated remarkably and with promising results in this field, but with more success in obtaining access to international information sources than in promoting the internal transfer of information.

It is also notable that in many cases public enterprise decisions cases regarding investments, the selection of technologies, and tasks involving technology transfers, follow older patterns as if completely oblivious to the explicit policies of the State regarding the conditions for such transfers. For example, unnecessarily expensive equipment is purchased in package deals, in part because these enterprises depend on large-scale capital investment projects rather than their current budgets for improvements and recuperation on deferred maintenance.

C. More recent trends

Recent trends in the literature and practice in the region can be cited as examples of an increasing momentum in the interchange of ideas and in the sophistication of research projects. The following are very positive examples of these trends:

- (a) Studies of innovation closer to the production line, recognizing that innovation in Latin America does not always need to be created in laboratory situations, but rather recognized where it exists, registered in texts and studies, and widely diffused 8/.
- (b) Studies of the effectiveness of instruments of technological policies. One goal is to overcome the continuing discrepancies between the second level of basic decisions (directives and guidelines for technological decisions) on the one hand, and the first (development plans) and third (programmes and administration of production and services) levels of decisions on the other hand. Another goal is to implement more effective regulation of imports of technology 9/.

/(c) The interest

- (c) The interest in alternative mechanisms of technical cooperation, as means of technological development, recognizing that the technical solutions to many problems in the region can be found in countries of the same region which speak the same language and of course understand the socio-economic realities of Latin America 10/.
- (d) Studies and analyses of the ideological content of the technologies, and of the key role of professionalization in reinforcing subtle forms of technological dependence, leading to the application of irrelevant and unnecessarily costly technological solutions to concrete problems in the region 11/.
- (e) Greater awareness of the variety of strategies of the trans-national enterprises which are expanding their operations in the region by means of the introduction of technological packages, and that simple favoritism or opposition to these enterprises does not produce the needed elements of negotiation regarding the technological transfers, on conditions most favorable to the region 12/.
- (f) Greater attention to the social and environmental effects of technologies 13/, with constructive attitudes and even interesting institutional innovations from organized labour, at least in some cases. However, in some countries there appears to be a tendency towards less rather than more concern by policy-makers regarding unemployment repercussions of technology.
- (g) Attempts to give priority, among the activities of the "science and technology infrastructure", to R & D on the processing of the country's own raw materials, as a means to reinforce the negotiating position with regard to the prices and conditions of exploration or sale of these raw materials 14/.
- (h) Greater emphasis on the development of the managerial function of implementing technologies. While this in itself is important, creating the possibilities of greater autonomy of decision in the hands of the Latin Americans, it is notable that the decision models used in the region very often are copied from "management" concepts whereby problems are reduced to a few "managable" variables (defined as "systems") and are

/usually defined

usually defined by one or another readily available solution 15/. The models should be compatible with decision styles more appropriate for countries which must consider a wide range of socio-economic variables, in relation even to specific technical decisions.

- (i) Criticism of technical assistance mores, with an attempt to set out codes of conduct for those giving such assistance, and criteria of selectivity for those receiving it 16/.
- (j) The development of technological information activities which permit more effective regulation of the import of technology and increase the power of negotiation for the information which is more difficult to obtain. The national registers of technology transfers in Argentina and Mexico are examples.

While these trends are exciting, they hardly remedy all the shortcomings identified with the early versions of the "science and technology infrastructure" strategy of the Latin American countries. Considerable analysis on the remaining problems is needed urgently, leading to the formulation of "codes of conduct" regarding technical assistance and other forms of technological transfers. Perhaps these "codes" could be differentiated according to substantive fields or economic sectors, given that the possibilities of technological innovation in the region are dependent on some factors (such as economies of scale) which the region must accept as "given" at least in the short run.

D. The political factors that lead to transfers of inappropriate technology

Another major need is a more dynamic analysis of the process of innovation, definition and diffusion or choice of technologies, with full identification of the political factors that enter into each of these phases. Such an analysis is essential in order to assume a realistic negotiating position regarding technology transfers and in order to identify correctly the elements which are responsible for the more subtle as well as the more obvious forms of technological dependence, whereby inappropriate or unnecessarily costly technologies are obtained. On the basis of such an analysis, future strategies would

/perhaps emphasize

perhaps emphasize less structural solutions, and more re-education (or de-professionalization) and systematic diffusion of information more. The following is a necessarily very schematic list of hypotheses and assertions, based on the results of Latin American case studies, which could orient a dynamic analysis of this subject.

1. Innovation and invention

- (a) As opposed to the thesis which argues that invention is cumulative 17/, in the sense that it is independent and motivated by technical necessity, it is more useful to consider the varied motivations and interactions of the inventor and the investor in situations where the latter is interested in cutting costs, winning wars, obtaining status or decreasing uncertainties of economic decisions. Improvements, in contrast to inventions, are normally directly related to immediate market conditions.
- (b) Prestige and information systems even in individual developing countries are weighted towards the diffusion of innovations sponsored by transnational enterprises rather than innovations founded on the immediate experience and problems of the country itself. This means that there are more incentives, but not necessarily more opportunities, for creativity in more industrialized than in developing countries.
- (c) There is a considerable potential for on-going, in-plant, minor and incremental innovation in developing countries, which is frustrated by the nearly exclusive association of progress with injections of large-scale technological packages and R & D activities 18/.
- (d) A key factor explaining the lack of recognition of the innovative capacity and opportunities for creativity in most Latin American countries is the generalized attitude that technological stagnation is inevitable unless a plant or infrastructure is provided with a minimum number of what are considered "modern" elements.

/2. The political

2. The political definition of technologies

- (a) When a new or apparently new technological item, such as a computer or locomotive, is offered in the international market, major interest groups study the manner to influence the definition of technological package based on this item. They will try to affect the choices made regarding software and types of personnel which will be considered necessary for the application or use of the technological item. They will try to help define "computerization" for the computer, "dieselization" for the locomotive, etc. The particular problems, needs and resources of the societies or organizations which will receive the technological package are less important to these groups than are the conditions of the society or organization for accepting the technology.
- (b) A technological package incorporates instructions for its use, indications of what performance data should be collected, and a set of performance standards against which this data are to be compared. These data and evaluation components, which are part of any technological change (or it may be the core of the change), are designed to record and evaluate events as if the technology was being implemented in any culture. These criteria do not demonstrate whether or not the technology is suitable or appropriate, but rather to what extent the recipient society or organization meets modern standards, or has successfully applied modern techniques. The feedback is technique-oriented, not oriented to cultural or organizational purposes or opportunities. It is presumed that the society or organization needs to adapt. The data and evaluation components of technological packages are thus perhaps one of the most subtle and effective instruments of dependence.
- (c) Technological packages commonly include normative assertions that the technology "requires" certain conditions or complementary investments, which become accepted on face-value without empirical evidence.

3. The selection of technologies

(a) The selection of technologies in recipient organizations or societies is closely linked to the strategy of reducing uncertainty. For that reason, the selection is often influenced by the following attitudes:

1. Preference for hardware solutions even for problems of organization and administration which have historically resisted resolution by the introduction of machines.
2. An emphasis on continuing large-scale capital investments, rather than on marginal less-costly changes.
3. Use of the technology for a particular set of services or products, rather than with the wide range of possible services or products which could be obtained from the technology.
4. A view of socio-political factors, and of labour, as forces to overcome or avoid rather than as sources of useful energy and checks to assume that the technology is relevant to social conditions and objectives.

(b) Due to the process by which technological packages are commonly defined, the selection of technologies is confined artificially to a limited set of choices. Thus, while technological progress is the widening of choices which are theoretically possible, this progress can lead to the sophisticated presentation of a limited number of possibilities which are in fact considered. Key reasons why developing countries accept this are (i) the generalized belief that there are technological imperatives, (ii) the attractiveness of analyzing a society's or organization's shortcomings in terms of the ability to adapt to a pre-defined technology rather than diagnosing problems and resources and choosing or inventing technologies appropriate for those problems or resources, (iii) the tendency to try to narrow the number of variables considered during the search for solutions and (iv) the defense by professional or other groups of an intermediary role with regard to technology, using the myth of "anti-politics".

//(c) Contradictions

- (c) Contradictions between the social implications of the technology which is selected and the pronounced global partisan ideology of the professional or technician generally go unrecognized by the professional or technician himself. The professional or technician disassociates three levels of ideology, not realizing that he is pronouncing and acting on contradictory principles. His global partisan ideology is normally associated with a political party or an attitude towards economic and political development. At a different level, he justifies and describes his professional or technical work in terms of social and economic consequences, often with only a vague relation to the global partisan ideology. Finally, detailed examination of the content of his work usually demonstrates a very different ideological orientation, often very surprising to the professional or technician when his attention is called to it 19/.
- (d) Particular criteria regarding the appropriate variables and values to be used in evaluations or analyses of technological alternatives usually accompany or become identified with the technological package. The "legitimate" range of values which can be assigned to such coefficients as useful life of the machine, residual value of machines that are replaced, investment/maintenance ratios and rate of return is generally quite ample (as much as 50% difference between the lowest and highest acceptable values). Almost any technological selection can be justified by the right combination of legitimate values for the basic coefficients, irrespective of the values which are obtained empirically for the other variables 20/.

4. The agents and conditions of diffusion of technologies

- (a) The multinational corporations are prime promoters of technological packages, often with a direct economic interest in this diffusion. Four prime strategies are used. First, the corporations invest considerably in the diffusion and selling of symbols, including trademarks, of the technological packages. Second, they attempt to maintain an artificial scarcity of technological information, taking advantage of legal devices (such as patents) to create such scarcity, and refusing to sell only the information they control but rather insisting on the purchase of entire technological packages which include

/such information

such information. Third, they multiply the benefits from their control of "know-how" by means of different tax, royalties, overpricing and other devices, especially where foreign subsidiaries can be established, all of which has been analyzed in depth by previous documents 21/. Fourth, the corporations have acquired increasing sophistication in their methods of obtaining general legitimization and acceptance of their own technologies. Recognition of the value of the technologies for universal application in the form that they are offered by the corporations, is obtained indirectly from banks and international organizations.

- (b) Professional groups in the organizations or societies which might apply or use a new technology identify themselves as the proper experts regarding the administration of the technology, to the extent that the technology appears to offer the possibilities of domination of a line of work which appeals to them and will not be disruptive of the stable environment which they consider conducive to their work. The professionals or technicians expand their work to incorporate new concerns and technologies usually in a long process of negotiation with their institutions of work and with other professions. Care is exercised to protect the exclusive "prerogatives" which have already been obtained to make decisions or studies, and to protect the "autonomy" of certain institutions (e.g. public enterprises) which the professionals or technicians come to consider as their own political domain.
- (c) The transfer of inappropriate technological packages, and the control of decisions regarding these technologies by professional or technical groups, depend on the existence of a national political structure favorable to such an approach to the selection of technologies. Among the structural factors are the following:
1. A tradition of assigning specific policy concerns to decision-making by professional groups. Career personnel systems and closed information systems, with special personal channels for access by elite groups to the professionals, are indicative of such a tradition.

/2. A regular

2. A regular sequencing or incrementing of economic benefits which are made to the most powerful political pressure groups, for example by means of cyclical credit policies which lead to rather regular variations in inflation rates.
3. A skillful centralized governmental apparatus capable of absorbing or repressing the pressures by newly mobilized pressure groups for governmental expenditures attuned to their more immediate needs.

(d) There are certain economic policies which tend to reinforce the acquisition of technological packages, unless explicit corrective measures are applied. Among such policies is that of import substitution.

Present strategies for organizing technological transfers too often ignore the crucial political factors, including at least some of those which have been posited here. As a result, the measures which are taken in order to increase the autonomy of decision and negotiating position of the Latin American countries are very inadequate, or result in the reinforcement of the very tendencies which are opposed in principle.

E. The sharing between Latin American and Western Pacific countries of their technological transfer experiences

The factors, including the political factors, that explain the generation, recognition, definition and diffusion or choice of technologies are appropriate subjects for joint study, analysis and experimentation by the Latin American and Western Pacific countries. An example of this convergence of interests is the case of transport containers.

The equipment which has been most notable and symbolic of international intermodal transport and cargo unitarization is the transport container. This is a transport instrument of permanent character, with a minimum volume, for repeated use, and relatively easy to fill, manipulate and empty. During the late 1950's and the 1960's, international economic interests, particularly in the maritime transport field, realized that the container not only offered an efficient means of transport but also a symbol of progress which they could use to promote

/a general

a general modification of transport and commercial practices. There are several reasons why these interests desired to change these practices according to their own preferred criteria. In particular, these interests realized that the developing countries were becoming more insistent and effective in demanding structural changes in the maritime conference system. Meanwhile concepts developed regarding the requirements and results of containerization. These concepts were elaborated in texts, technical manuals, technical bulletins and professional journals, and were spread along commercial information channels and by means of technical assistance. These concepts took on an aspect of universal knowledge, even though they had not been tested in a variety of conditions and their overall social and economic implications remained to be studied. In 1971, certain European countries responded to the pressures from these interests and promoted the adoption of an international convention on intermodal transport which would have legitimized a new form of institutionalization of maritime and other transport in a manner favorable to the maritime interests of the most industrialized countries, and which apparently would have weakened the impact of the developing countries' movement to reform the maritime conference system. The draft convention was promoted as necessary to resolve specific transport liability problems created by the use of transport containers, and was proposed for adoption at a forthcoming United Nations' meeting on containers in late 1972, but the repercussions of the convention, if adopted, would have led to legal justification for a large-scale modification of international commercial and transport procedures which was already being implemented on certain major international trades. Already in late 1971, Latin American countries began to question the draft convention, and the Economic Commission for Latin America began to produce studies of the draft convention, pointing out its weaknesses as a legal document, and of the economic and institutional implications of the rationalization of international commercial and transport procedures which certain interests identified as logical and crucial in order to take advantage of new transport equipment 22/. The draft convention was not considered in the hurried fashion which the European interests sought, and studies were produced showing the new system of organizing transport had unexpected consequences, some of them rather negative, in the case of Australia's foreign trade 23/. The Australian users, land transporters, Government regulators of transport and even the national merchant marine have faced some disappointing consequences of this system, even while security and expedition of the cargo have been improved. During further negotiations on the question of the international convention, which continue in UNCTAD, Australia and

New Zealand withdrew their support from the European position, and are seeking an alternative position. Aware of the impact of the system in Australia, the Latin American countries now generally favour the adoption of a convention, but one of public law and quite different from the earlier drafts, with the hope that such a convention would help them protect their own merchant marines, users, land transporters, insurers and other affected sectors. The European countries which sponsored the 1972 draft now are more reticent, finding that time and commercial pressures originating in those countries favour the implementation of their preferred rules-of-the-game, without a convention. Meanwhile, the use of the container continues to expand among the Latin American countries, which are pressured individually to accept the sophisticated handling equipment, changes of customs' procedures, arrangements for leasing of containers, and reorganization of the transport sector along the lines which the transnational companies define as "containerization" or "intermodal transport systems". Naturally, some technical groups and interests in the Latin American countries are swayed by the large amounts of material which attempt to justify a package concept of what the container is all about. Meanwhile, access is very difficult to concrete data about who benefits from containerization, or to cost data to determine what elements of the technological package represent major economies and benefits for the Latin American countries. As a result, it is difficult to preserve the autonomy of decision in Latin America regarding the introduction of this technology.

This case study has had to be overly brief, but it does dramatize a situation where the Western Pacific and Latin American countries share common problems with regard to the transfer of technology. On the one hand, Australia has innovated in trying to deal with this situation, especially by strengthening the negotiation position of user groups in order to countervail some of the effects of the reorganization of its international transport. This experience could be valuable for Latin America. On the other hand, the analysis and criticisms made by Latin American countries and by the Economic Commission for Latin America of the situation could be suggestive of foci on the problem useful to Australia and New Zealand.

Not only in the case of containers, but also with regard to many other technologies, there appear to be five types of joint action which would be mutually beneficial to Latin America and to the Western Pacific countries.

/1. There would

1. There would be benefits in carrying out joint pilot projects and experiments, such as those carried out by the PPTT project of the OAS mentioned earlier, on the transfer of technologies of common interest to all of the countries involved. These would serve as case studies, but with the goal of providing concrete experiences of immediate use to the countries. Traditionally, these projects and experiments are carried out in relation to the technological requirements of enterprises which have depended in great measure on imported technology. An alternative approach is to identify common problems in the interested countries, such as communications and transport means for the extension of social services across space in the case of Australia and the larger Latin American countries, with the goal of searching for unique and appropriate technologies for these problems. The purpose of a joint activity in this regard would be the development of case studies of benefit to all of the participating countries, taking advantage of the different experiences regarding theoretical perspectives and social science methodologies. Also, unique and useful older technologies would be evaluated 24/.

2. All of the Latin American and Western Pacific countries spend considerable resources in searches of information on technologies with origin in the European and North American hemispheres. Much of this search activity is unnecessarily repetitive and inefficient. In this regard, there are two activities which could be carried out on a collective basis.

First, Latin American and Western Pacific countries could join forces in assuring the development of international information systems in such a way that these systems respond to the needs of these countries. There are many technical problems involved in the organization of an international information system, and too often these problems are solved with greatest attention given to the countries that are the major immediate providers, as opposed to the more geographically distant users of the information. This is especially important now that the United Nations is carrying out a feasibility study on the progressive establishment of an international information exchange system for the transfer and assessment of technology 25/, that the International Standardization Organization is finishing work on an ISO Thesaurus to be the controlled vocabulary of the ISO Information Network, that the International Classification of Patents is undergoing revision and new international patent information search procedures are considered for the implementation of the Patent Cooperation Treaty of 1970, that the Common Registry (CORE) of United Nations' projects is under

/development, and

development, and many other activities sponsored by UNESCO and other organizations are underway in order to improve accessibility to and retrieval of technological information. It is important to the Latin American countries that this information be classified according to criteria pertinent to the problems of the region, and that the information be made available at the lowest possible search costs. In this regard, this appears to be a concern also of the Western Pacific countries.

Second, there could be a complementation of search activities. It is well known that Japan applies many different information acquisition strategies, including visits directly to centres of technological invention. In specific fields of common interest, Latin American and Western Pacific countries might join in carrying out these strategies on a systematic basis. Techniques of obtaining this information at the least cost need to be considered. For example, the Latin American experience has not been satisfactory in the search of patent files abroad, due to poor relevance ratios, and alternative search techniques need to be evaluated in this regard. Likewise, the experience in obtaining information directly from the multinational enterprises has been quite spotty, and study needs to be made of the benefits and techniques of taking advantage of the new information laws of some of the more industrialized countries in order to obtain information regarding regulated enterprises from files in those countries which are now open to the public. Of course, the countries which engage in this search often hope to recuperate some of the costs by selling the information, or technologies and products based on this information, to other countries; thus there could be reticence to collaborate in the search process. In some fields, however, the nature of technological developments and the dependence on information from outside are not markedly different in the Latin American countries and in the Western Pacific countries. The possibilities of profiting greatly from a role of technological information broker are thus more limited, and there could be more interest in joint action.

3. The Latin American and Western Pacific countries have a common interest in the development of mechanisms by which their industries and services can protect their access to international markets. This problem lends itself to joint action at two levels.

First, advantage could be obtained from the experience of Australia and Japan, and of some of the Latin American countries, in the development of sectorial associations, or Government agencies, to

/consolidate the

consolidate the point of view of a national sector (such as insurance, maritime transport, raw materials producers, etc.) and forcefully present this point of view in international commercial negotiations. Technical assistance regarding the organization of this type of protection is in order.

Second, consultations would be useful regarding possible unified negotiating positions among Latin American and Western Pacific countries with regard to some international technological issues, not with the intention of fostering confrontation on technological questions with other countries or of replacing existing regional negotiating groups, but with the idea of examining the feasibility from different points of view of alternative solutions to perplexing problems involving the transference of technology. Since certain countries of both of these regions have suffered some similar consequences of the transfer of technological packages, and these consequences are not always apparent to the countries in these same regions or other developing regions which are just beginning to take contact with the multinational enterprises which sponsor these technological packages, a pooling of experiences and ideas could be most beneficial in clarifying the most appropriate strategy for all countries which have large-scale development possibilities or needs.

4. There are innovations with origin in Latin America and in the Western Pacific countries which could be subjects of technical cooperation projects. In the Economic Commission for Latin America, twelve different important innovations in the transport field have been identified as potentially interesting for transfer within the region. The United Nations' Development Programme is sponsoring the search for innovations in various fields. It is quite likely that some of these innovations could be of interest to Western Pacific countries, and such possibilities could be studied by the universities. Alternative mechanisms for technical cooperation, including the exchange of technical missions, on-site training and information gathering and dissemination could be tested.

5. One of the most crucial and difficult areas of collaboration is that of professional reeducation, with the objective of reducing the impact of those aspects of professional formation and attitudes which reinforce technological dependence (e.g. the selection of inappropriate or unnecessarily expensive technologies in packages), as opposed to more constructive technological interdependence. It

/appears that

appears that the conditions of professional development which reinforce dependence vary somewhat from country to country. Nonetheless, there is a general need for constant reeducation in order that the professional not only is aware of new technologies but is given encouragement, incentives and tools to relate his work ever-closer to the realities of his society and organization 26/. The analysis of this problem and experimentation with continual reeducation can be richer, and can be made more attractive to the professionals themselves, if based on comparative studies and collaborative efforts among countries, that have different conditions of professional activity but a same basic need for modifying professional attitudes 27/.

Conclusion

This presentation has set out some basic assumptions and hypotheses regarding transfer of technology, with particular attention to making explicit the political factors which shape present transfers, and has proposed lines of study and action which would extend the positive trends in the field in Latin America. The studies and actions which are proposed could be carried out in collaboration with the Western Pacific countries, to the mutual advantage of these countries and the Latin American countries, especially given certain similarities of experience and situation with regard to the problems of technology transfers and the possibilities of technical cooperation.

FOOTNOTES

- 1/ Pertinent references may be found in the large bibliography prepared by the Escuela Superior de Administración de Negocios in Lima, Perú, TECNOLOGIA PARA EL DESARROLLO, Lima, Perú, January 1975.
- 2/ Francisco R. Sagasti and Mauricio Guerrero C., EL DESARROLLO CIENTIFICO Y TECNOLOGICO DE AMERICA LATINA, Buenos Aires, Institute for Latin American Integration (INTAL/IDB), 1974; Constantine V. Vaitsos, "The Process of Commercialization of Technology in the Andean Pact" (Lima, Perú, October 1971), mimeo.
- 3/ Francisco R. Sagasti, A FRAMEWORK FOR THE FORMULATION AND IMPLEMENTATION OF TECHNOLOGY POLICIES; A CASE STUDY OF ITINTEC IN PERU, Interamerican Forum on Technological Development, Austin, Texas, 24-27 February 1975.
- 4/ This general conceptualization of "paradigm" was given currency especially by Thomas Kuhn, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS, Chicago, University of Chicago Press Phoenix Edition, 1962, first published 1962. The specific interpretation meant here refers to the range of activities which a group of technocrats considers to be its own, described by a specialized language and a set of techniques created for their work.
- 5/ This study concludes that the Chilean engineers working in public enterprises have tended to divide into three groups: a group of "strict modernizers" intent on pushing for the forthright implementation of the paradigm predominant in their profession in a given moment, considering this to be the solution to the production, organizational and "political" problems of the enterprises; a group of "technicians" rather comfortable with their specific assignments, although interested in making on-line marginal innovations; and a group of "moderate modernizers" interested in more substantial transformations of the enterprise not only in terms of the latest technology but also in terms of service to the community, and rather astute politically at negotiating for acceptance of such changes inside and outside of the enterprise. The inter-relation of these groups results in cycles in attempts at innovation.

/win Crowther,

Win Crowther, **TECHNOLOGICAL CHANGE AS POLITICAL CHOICE: THE CIVIL ENGINEERS AND THE MODERNIZATION OF THE CHILEAN STATE RAILWAYS**, Doctoral dissertation, Department of Political Science, University of California, Berkeley, California, 1973, pages 393-801.

The idea of cycles of introduction of innovations by groups of professionals and technicians is also developed, and studied in French enterprises, by Michel Crozier, **THE BUREAUCRATIC PHENOMENON**, Chicago, University of Chicago Press, 1964.

- 6/ Thus Joseph Hodara's book, **PRODUCTIVIDAD CIENTIFICA**, Mexico, Universidad Nacional Autónoma de Mexico, 1971, actually describes the requisites to production rather than productivity of science. Hodara deals more directly with the problem of relevance in **POLITICOS VS. CIENTIFICOS**, Mexico, Universidad Nacional Autónoma de Mexico, 1971. A fine brief treatment of the difficulties of analyzing the relevance of technologies is made in Nuno Fidelino de Figueredo, **A TRANSFERENCIA DE TECNOLOGIA NO DESENVOLVIMENTO INDUSTRIAL DO BRASIL**, Rio de Janeiro; Instituto de Planejamento Econômico e Social, 1972, pages 32-42.
- 7/ Organization of American States, **INFORME FINAL: PROYECTO PILOTO DE TRANSFERENCIA DE TECNOLOGIA**, preliminary version, Washington, D.C., June 1975, SG/P.1, PPTT/34.
- 8/ There has been special interest in this problem in Argentina, as the previously cited document of the Organization of American States attests. Also, the Economic Commission for Latin America and the Inter-American Development Bank are carrying out a joint project, based in Buenos Aires, on this subject.
- 9/ This theme is a major concern of the Science and Technology Policy Instruments project, based in Lima, Perú, and financed by the International Development Research Centre of Canada.
- 10/ The Economic Commission for Latin America is formulating concrete proposals for projects of technical cooperation in different technological fields, including agriculture and transport, in conformity with resolution I of the Meeting on Latin American Science, Technology and Development in Mexico City, 2-6 December 1974, sponsored by the Commission, and the resolutions 354 (XVI) and 357 (XVI) of the Commission at its 17th. session in Port-of-Spain.

/11/ For example,

- 11/ For example, see Oscar Varsovsky, ESTILOS TECNOLOGICOS; PROPUESTAS PARA LA SELECCION DE TECNOLOGIAS BAJO RACIONALIDAD SOCIALISTA, Buenos Aires, Ediciones Periferia, 1974.
- 12/ The Economic Commission for Latin America is carrying out studies on this subject, in relation to international intermodal transport, bananas, bauxite, tin and lumber. A bibliography on the subject has been prepared by the Organization of American States, BIBLIOGRAFIA ANOTADA SOBRE EMPRESAS TRANSNACIONALES CON ENFASIS EN AMERICA LATINA, Washington, D.C., 1974.
- 13/ The International Labour Organization has published a large number of case studies on this subject.
- 14/ This has been especially evident in the Andean countries. Francisco R. Sagasti, "Integración Económica y Política Tecnológica: el Caso del Pacto Andino", REVISTA DE LA INTEGRACION, 18 January 1975, pages 169-181.
- 15/ Win Crowther and Gilberto Flores, PROBLEMAS LATINOAMERICANOS Y SOLUCIONES ESTADOUNIDENSES EN LA ADMINISTRACION PUBLICA, Santiago, Universidad de Chile, Instituto de Administración, 1970.
- 16/ Latin American Railway Association and United Nations' Economic Commission for Latin America, EXPERIENCIA EN PROYECTOS DE ASISTENCIA TECNICA EN FERROCARRILES DE AMERICA LATINA CON MIRAS A MEJORAR SU EFICACIA, Santiago, August 1975, E/CEPAL/L.121.
- 17/ Nathan Rosenberg, "The Direction of Technological Change: Inducement Mechanisms and Focusing Devices", ECONOMIC DEVELOPMENT AND CULTURAL CHANGE, October 1969, pages 1-24.
- 18/ Stephen C. Hill and R. Martin Bell, "Paradigms and Practice: Innovation and Technology Transfer Models --their Unexamined Assumptions and Inapplicability Outside Developed Countries", Draft, Science Policy Research Unit, University of Sussex, August 1974, mimeo.
- 19/ The ideological content of the technocrats' studies or decisions may be demonstrated in two ways. One method is to examine the variables which are taken into account. Another method is to examine the sources of the information which is used to determine the values of the basic coefficients involving space, time or the relationship

between cost and benefit. In both methods, a particularly important factor is the group of beneficiaries, or users, which is implied. All technological decisions and projects involve redistribution of resources from one group to another. Very often the supposed beneficiaries are not the real beneficiaries, as can be determined by a careful content analysis.

- 20/ A demonstration is made of this in Crowther, op. cit., Annex V.
- 21/ Constantine V. Vaitsos, "Bargaining and the Distribution of Returns in the Purchase of Technology by Developing Countries", BULLETIN of the Institute of Development Studies of the University of Sussex, October 1970, pages 16-23; Industrial Development Division of the United Nations' Economic Commission for Latin America, "La Transferencia de Tecnología Industrial Extranjera de los Países Latinoamericanos: Características Generales de Problemas y Sugerencias para la Acción", in ENSAYOS SOBRE POLITICA TECNOLÓGICA EN AMÉRICA LATINA, edited by Karl-Heinz Stanzick and Peter Schenkel, Quito, Ecuador, Instituto Latinoamericano de Investigaciones Sociales, 1974.
- 22/ The United Nations' Economic Commission for Latin America has prepared a series of reports on the institutional, social and economic facets of unitarization and international intermodal transport systems. See especially LATIN AMERICAN DEVELOPMENT AND THE UNITED NATIONS/IMCO CONFERENCE ON INTERNATIONAL CONTAINER TRAFFIC, Santiago, 20 December 1971, E/CN.12/912/Rev.1; ECONOMIC AND INSTITUTIONAL IMPLICATIONS OF THE NEW TRANSPORT TECHNOLOGIES IN LATIN AMERICA, Santiago, 17 September 1974, E/CEPAL/L.113; and in collaboration with the Institute for the Integration of Latin America, SERVICIOS DE TRANSPORTE TERRESTRE INTERNACIONAL EN LOS CORREDORES LIMA-BUENOS AIRES Y LIMA-SAO PAULO, Buenos Aires, 1975, E/CEPAL/1007.
- 23/ United Nations' Economic Commission for Latin America, "Containerization: Its Impact on the United Kingdom/Australia Trade", ECONOMIC AND INSTITUTIONAL IMPLICATIONS OF THE NEW TRANSPORT TECHNOLOGIES IN LATIN AMERICA, Santiago, 17 September 1974, pages 48-60.
- 24/ The present situation regarding the prices and environmental effects of pollution has led to renewed interest in adaptations of older transport and communications technologies. For example, the dirigible could be an appropriate technology for transport development in the

/Amazon Basin.

Amazon Basin. Also, decentralized information systems may not only be less energy-using, but also more effective in many cases in delivering information opportunely, than is the case with centralized computer processing. A general argument for this backward look is that of Ivan Illich, *ENERGIA Y EQUIDAD*, Barcelona, Spain, Barral Editores, 1974.

25/ United Nations' Economic and Social Council Resolution 1902 (LVII).

26/ This reeducation can be direct by means of seminars, T-groups and other techniques of modifying the attitudes of the professionals, especially by helping them to examine their own immediate experience from different points of view. The methods of education used by Paulo Freire with rural groups could be adapted for this purpose. Alternatively, the reeducation can be indirect, by building up pressure groups in the society to impress their points of view on the professional. This approach has been experimented a great deal in India. See Paulo Freire, *PEDAGOGY OF THE OPPRESSED*, New York, Heder and Heder, 1972; Lauro de Oliveira Lima, "El método Paulo Freire", *TECNOLOGIA, EDUCACAO E DEMOCRACIA*, Rio de Janeiro, Brazil, Ed. Civilizacao Brasileira, 1965; Amba Prasad, *INDIAN RAILWAYS: A STUDY IN PUBLIC UTILITY ADMINISTRATION*, Bombay, India, Asia Publishing House, 1960.

27/ A pertinent analysis of the Chilean professional has already been cited in footnote 5. In Japan, the engineer is trained to fit into a rather passive role of organizing production of imported technology in a cycle of dependence. This is analyzed by Kenichi Ohmae, "Yokkakari: The Cycle of Dependence in the Japanese Corporation", *TECHNOLOGY REVIEW*, January 1975, pages 40-47.

